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DISTRIBUTION AND OCCURRENCE OF WHITE PINE (*PINUS STROBUS* L.) AND RED PINE (*PINUS RESINOSA* AIT.) AT THE NORTHERN LIMIT OF THEIR RANGE IN ONTARIO

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With three plates

INTRODUCTION

IT IS MORE THAN FIFTY YEARS since Robert Bell published the last of his several papers (2, 3, 4) on the distribution of forest trees in eastern Canada, and laid down on a map his final representation of the northern limits of the principal species east of the Rocky Mountains.¹ In the interim, knowledge and understanding of the forests of eastern Canada have been greatly advanced, thanks to exploration and the progress of research in several fields; but little has been added in the literature to what Bell said concerning the actual geographical distribution of forest trees, especially at the northern limits of range.² His work in that field remains the principal source to which are indebted the authors of standard and popular works published since the beginning of the century.

* The author has compiled a check list of stations for white pine and red pine at the northern limit of their range in Ontario, published in 1948 and cited as (12) in the bibliography accompanying the present paper. Through the kindness of the Ontario Department of Lands and Forests, separates of the check list are available and will be mailed to subscribers to the Journal of the Arnold Arboretum.

1 Bell's first contribution was a map, the first of its kind in Canada, which showed the northern limits of the principal timber trees in the original Canadian provinces. That map was published in 1879 under the authorship of A. T. Drummond (6); but according to the latter is attributable to Bell and Drummond jointly. According to Bell (4) it was drawn originally by him in 1873. It was used by the Canadian Department of Public Works in the preparation of the first official tree range map in Canada.

2 Reference is made to the presentation of authentic distributional data. In 1905 Transeau (14) showed on a map, by means of varying depth of shading, the extent and overlapping of the ranges of several conifers in the northeast, but he did not record any new stations. Later (15) he illustrated the ranges of red and white pine on

Was Bell's work truly exhaustive? No great change could be made in the position of the tree lines on his map. His account of isolated and rare occurrences of several species, remarkable in itself, remains of interest and value to-day, — the more so since some of the stations described have already disappeared, and others are threatened by exploitation. But Bell recognized that his account of distribution was far from complete in detail, and that his map might even be misleading in part. Thus he said that the tree lines were "general boundaries," and that occasional or "chance" trees were known to occur beyond them. Again, he remarked on the extraordinary scarcity of stations at some places within the lines, and expressed doubt as to where the boundary should be placed. In thus picturing the broad configuration of the northern limits of distribution, the true character of the boundary zone was not represented. That character is of prime importance and is highly significant in the interpretation of vegetation dynamically.

In the course of exploration and development of the country since the beginning of the century, many new and relevant observations of tree occurrences have been made, which together comprise an important body of distributional data. These for the most part have failed to find their way into print, or have remained isolated and inaccessible, without benefit to the literature of forest geography. A notable contribution, however, was made by Halliday and Brown (8), who introduced new data and employed a novel method of illustrating the distribution of some of the principal Canadian forest trees. One of their aims was to show the relative importance (abundance) of each species throughout its range. For that purpose population density class maps were prepared from a large body of timber cruise data; but having few for red and white pine deemed suitable for their purpose, those species were not dealt with.

That omission was doubtless warranted, for exploitation over a period of two hundred years has greatly modified the natural distribution of red

small maps by means of dots; but for northern Ontario his representation was purely conventional. In detailed studies in Ontario relating to distribution, Hutchinson (9) did not present new geographical knowledge. His tree lines were essentially those of Bell. Sudworth (13), in his atlas covering *Pinus*, showed the distribution of each species by a field of solid colour. In a commentary, Fernow (7) criticized the "scaloped outline on the outskirts" of the field representing the distribution of white pine, and queried whether certain discontinuous parts were truly representative, or merely suggestive. Moreover, he stated that "... what is really much more needed, and would prove of exceeding value, is the detail distribution on a large scale map, even if it were of only a limited number of species, and especially of their outskirts, when the ecology of the species could be brought out with more satisfaction." In 1938 Munns (11) prepared distribution maps after the manner of Sudworth, by compiling "reliable information from many sources," published and unpublished. For red and white pine, which were pictured separately, the northern limits in Ontario were approximately as shown in the Dominion government atlas maps published in 1906 and 1915. These had departed slightly from Bell's map in showing red pine farther north than white pine, as had been suggested in Bell's text. In 1941 the Ontario Department of Lands and Forests published an atlas containing a map showing tree lines in the province (1). Recently a compilation of the data which are the basis of the present study was issued by the same service (12).

and white pine quantitatively throughout a large part of the range of those species. Their northern limits in Ontario, however, have remained comparatively undisturbed until recently; and for the parts where logging has encroached there, data representing virgin conditions are available.

Actually red and white pine offer peculiar advantages for distributional study. Their large size renders them comparatively conspicuous in the northern forest. Moreover their commercial value has been the cause of their being reported carefully and regularly in explorations and surveys under government supervision from the earliest days to the present time.

In view of the above it seemed both appropriate and feasible to undertake a detailed investigation of the distribution of red and white pine at the northern limit of their range. The following pages comprise the results of such study in the province of Ontario.

METHOD AND SOURCES

Common knowledge suggested the preliminary definition of a base line or datum beyond which the occurrence of red and white pine might be taken to be local, sporadic, or rare. That line was chosen as follows: — From the Quebec boundary westward along the height of land between the St. Lawrence and James Bay waters to the height of land portage on the Michipicoten—Missinaibi route to Moose Factory; thence southwesterly along that route to Michipicoten and westerly along the shore of Lake Superior to the head of Black Bay; thence along the north boundary of the township of Dorion and its projection due west through Dog Lake to the Canadian National railway, and along that line through Sioux Lookout and Kenora to the Manitoba boundary.

All reliable records of occurrence of white or red pine north of that line known to the writer have been assembled elsewhere (12), and are plotted on the maps herewith. For these data I am indebted principally to the reports of land surveyors, who, since the beginning of government administration in Ontario, have carried out explorations, meridian and base line surveys, township subdivisions and lake and river traverses on the Crown lands. As already indicated, in the course of that work they regularly described the forest conditions, and in particular noted the occurrence of red and white pine timber. To their reports have been added unpublished records derived from personal observation and information received from correspondents. For the latter I am indebted chiefly to associates in the Department of Lands and Forests, especially to Messrs. J. Barron, R. Boulton, J. A. Brodie, W. D. Cram, Q. Hess, H. Hills, T. E. Mackey, W. J. Robinson, J. Ruxton, R. Taylor, and B. Wilson.

In assembling the records and in plotting them, it was necessary to distinguish "stands" from "scattered trees," and from "single" or "isolated" trees. Admittedly the distinction between those classes was not always an easy one to make. In general a "stand" represents a community (*Pinetum*), while "scattered trees" represents occurrence where from the

station occupied by the observer, several to many widely separated individual trees could be seen. Some of those trees may have been virtually isolated. "Single" or "isolated" occurrences are those where one, or not more than seven trees in a group were found remote from other specimens. Veritable single tree occurrences, of which a number are known, are recorded elsewhere (12).

For the most part these reports antedate forest exploitation in the regions concerned. The picture of distribution given may be taken therefore as representing virgin conditions.

DISCUSSION

Occurrences of white and red pine north of a line already described are plotted on maps herewith. The actual distribution of those species there is seen to be referable to eastern and western sectors, the region north of the central part of Lake Superior being virtually without occurrences. The few known stations for red pine there are rightly regarded as isolated and quite exceptional.

In the western sector both red and white pine range considerably farther north than in the east. There, too, in the peripheral zone as generally, red pine is much commoner than white pine; while in the east (and in the Nipigon area) the reverse is true. The relative abundance of red pine increases toward the north throughout.

The general configuration of the northern limit of distribution parallels the yearly isotherms and is related to the length of frost-free period. Thus the region to the north of Lake Superior, which is apparently not unfavourable for pine edaphically, has a shorter frost-free season than contiguous areas to the east and west. Similarly, in the sector outlined by the limit of pine west of Lake Superior, spring comes two weeks earlier than farther north and east.

Within the selected border zone pine is almost everywhere sporadic or rare; but its frequency of occurrence varies in different parts, as can be shown quantitatively. If by "occurrence of pine" is meant the report of occurrence, whether of stand, scattered trees or single trees, the rate of occurrence per thousand square miles may be stated approximately for different regions as follows:

<i>Region</i>	<i>Rate of occurrence of pine per 1000 square miles</i>
District of Sudbury north of the height of land	22
Districts of Temiskaming and Cochrane north of the height of land as far north as town of Cochrane	8
District of Algoma north of Michipicoten	5
Territory west of Lake Nipigon north of a selected line	3

The above frequencies indicate that isolation and disjunction, increasingly significant toward the north, characterize the distribution of white and red pine throughout the whole of the area considered. The depth of the zone in which pine is sporadic or rare is generally more than one hundred miles.

In the east the principal concentrations of pine north of the height of land were originally in the area bordering Lake Mattagami and the parallel waters of Grassy River, including Kapiskong, Nursey, and Sinclair Lakes. That country was referred to in a general way by Cavana and Watson in 1911 as "a locality eminently suited to the growth of red and white pine, but this timber is not greatly in evidence." It continues to supply to this day, however, some pine logs for the mills at Timmins.

There is also a noteworthy concentration of pine in scattered stands in the vicinity of Horwood Lake, some of which remains. That region was described by Speight and van Nostrand in 1907 as "the most promising for white and red pine that we have seen in the James Bay watershed."

The township of Frater, too, originally contained a considerable amount of red and white pine timber. Farther west, fires have possibly obliterated evidence of pines in historical times; but the known occurrence of scattered veterans in the country north of Chapleau suggests a former concentration there. Similarly, pine occurrence is indicated west of Missinaibi, in the vicinity of Manitowick Lake, though few trees remain there now.

A few noteworthy stands of red pine are known even farther north in the district of Algoma. A well known one on the portage from Oba River to Kabinakagami Lake, in Derry Township, which was first reported by Baird in 1900, still remains. But that one which formerly stood where the railway now crosses the Kabinakagami River is gone completely. It furnished convenient piling for the numerous trestles built during railway construction.

On the Nipigon drainage, a considerable amount of pine has been cut, and some remains. One of the principal stands was possibly that which formerly stood in the vicinity of Pine portage on the Nipigon River, which was described by Herrick in 1860. Other concentrations occurred in Innes Township, where until recently red pine stood on the shore of Lake Nipigon. Around Kabitotikwia and Black Sturgeon Lakes, remnants of once fairly extensive stands, principally of white pine, can still be found.

In the peripheral zone west of Lake Nipigon, it is scarcely possible to recognize concentrations of pine. Occurrences of both species are extremely rare and widely scattered. There are stations for white pine on Sturgeon Lake, lac Seul, Pakwash and Red Lakes; and for red pine on Savant Lake, Lake St. Joseph, Red Lake and Nungesser Lake. Perhaps the chief centre for white pine was around the west end of Sturgeon Lake. Both species are scattered here and there on the shores and islands of the central part of lac Seul. The largest stand of red pine is on Thaddeus Lake, near lac Seul.

In the northern clay belt area, the principal concentration of white pine (with considerable red pine, too) was undoubtedly that which formerly covered the sand hills in Dundonald and Evelyn Townships, near Frederickhouse Lake. A smaller stand of fine quality occurred in the township of Edwards some distance to the northeast. The principal stand of red

pine, long since cut, was at the outlet of Abitibi Lake, in the township of Kerrs. There was formerly a small stand of red pine on a point of land extending into a lake near the central part of Alexandra Township. A remarkable grove, the most northerly known in these parts, still stands on the shore of Lake Montreuil in Swartman Township.

Although white and red pine are already comparatively rare and of sporadic occurrence in the forest some distance south of the northern clay belt, they are found much less frequently once that area is entered. Yet it is noteworthy that both species penetrate it deeply and are found at widely scattered stations where soil conditions are favourable. In the Temiskaming clay belt, however, pine was originally much commoner than in the northern one.

Within the so-called clay belt areas, the extensive clay and silt deposits are generally unsuitable for the growth of pine, especially as compared with spruce, with which it must compete. When pine occurs it is found on sandy or gravelly deposits, on rocky hills or on occasional rocky shores of lakes and rivers, and on islands. The deep extensive morainic deposits in Dundonald and Evelyn Townships must have stood as islands in glacial Lake Ojibway. Smaller deposits, evidently of fluvio-glacial origin, appear to have been water-washed to sandy and gravelly bars of scarcely perceptible elevation. On such sites both red and white pine have been found. For the most part, however, red pine occurs on the coarser gravels of eskers and kames, especially where they protrude as sharp points or hog's backs into lakes.

The two species differ considerably in their sociability. Red pine is usually gregarious, even at the extreme limit of its range. The stands, however, are small, often comprising only a few acres or less. They usually appear to be roughly even aged, though poles, saplings and smaller trees are not unknown, especially at the margins of mature groves. In the case of white pine, occurrence is typically "scattered" or "scattering" — adjectives that recur in the field notes with monotonous frequency. Such trees are often virtually isolated individually, and certainly do not any longer represent a pine community. Usually large and overmature, though cones are borne from time to time, they are not replaced when they fall. That such trees sometimes represent a former pinery is evident from the presence of stubs and fallen timber in various stages of decay. The approximate even age of the timber left suggests, too, a common origin for all.

Scarcity of young pines, especially white pine, is strikingly characteristic throughout the northern boundary zone. While it is probably true that observation and reporting have not been as satisfactory for small trees as for large ones, the reports undoubtedly reflect an actual dearth of reproduction. Young trees, which were taken as trees reported in the notes as young, small, or less than twelve inches in diameter, were noted only twenty-five times in a total of three hundred and seventy-one pine observations.

That white pine formerly occupied areas where it is now entirely absent is evident from some early survey reports. According to McAree, the township of Homer, in the district of Thunder Bay, contained no standing pine when he surveyed it in 1872; but he said that charred stumps of white pine and cedar of large size were all through the woods, the country having been burned over fifty or sixty years earlier. Similarly, McAuslan and Anderson, reporting on Nassau and Storey Townships in 1915, found no pine there at that time, but said that much of the land had formerly been timbered with cedar and white pine, which had been destroyed by fire and succeeded by spruce. A few scattered specimens of white pine still standing in Langemarck and Dowsley Townships, and the two single trees recently found in Rogers and Studholme Townships, are possibly remnants of a once extensive forest in which that species was well represented. Again, there is at least the suggestion that white pine (or possibly red pine) formerly occurred in Chipman and O'Meara Townships northeast of Longlac. The lake in those townships shown on map No. 23a Province of Ontario, as "Chipman Lake" was formerly known locally as "Pine Lake" and was thus marked on a map published by the Crown Lands Department in 1901. The reference would hardly be to jack pine. Attention may be drawn here to Bell's report of stories to the effect that white pine once extended considerably farther north along the principal tributaries of the Moose, but that it had been destroyed by fire there and was succeeded by other species.

This picture of actual distribution suggests decadence and retreat. Isolation is evidently acting here against reproduction, and therefore as a barrier to migration. For these scattered trees are almost certainly self-fertilized, which for white pine results in seedlings of comparatively low vigour; and for red pine in a reduction of the amount of seed set, as shown experimentally by Johnston (10). These handicaps contribute to failure in competition with other species, to which white pine especially is exposed.

On the other hand it cannot be denied that some few white pines have grown as isolated pioneers in new localities. Thus a single tree, now gone, which formerly stood on an island in the Mattagami River in Harmon Township, was almost certainly a pioneer from seed brought with flood wood from the headwaters of the river. Standing twenty miles from its nearest neighbors (a group of five old pines on another watershed, themselves thirty miles or more from any other known station) it is significant, perhaps, that the tree failed to reproduce itself. The extraordinarily rare occurrence of three young white pines, some twenty feet high, on top of a rocky bluff overlooking Penelton Lake in Opazatika Township, is harder to account for.

It is of interest to speculate on the origin of the forest biota populating the zone in which red and white pine now find their northern limit. From what source or sources have they been derived, and what has been the direction and chronology of migratory movement? It is evident that the

concept of migration from remote refugia is valid only in its broadest application. The evolution of the glacial lakes precluded the possibility of a uniform advance in the wake of the ice; — water coverage has played a role no less important than ice coverage, locally, in the history of revegetation in northern Ontario. Thus the western area of the province, except below the level of Lake Agassiz, has been exposed throughout the relatively long period of Algonquin time, and subsequently. On the other hand, farther east Algonquin waters covered most of the present "compact" area of pine distribution in the upper lakes drainage in Ontario until comparatively recently. But the surface of Lake Algonquin was not uninterrupted. Besides the great Pukasaw promontory which Coleman (5) thought was exposed, large land masses to the east, well over 1500 feet above sea-level, must have stood as islands in the lake. The largest of them, an area of some twelve hundred square miles, centres on the upper waters of the Mississagi River. Another highland area of some two hundred and fifty square miles lies at the headwaters of the Montreal and Chapleau Rivers. These and smaller areas were well situated to reforest the bed of Lake Algonquin as the waters receded to the Nipissing Great Lakes levels. That forests existed on the north shore of Algonquin can scarcely be doubted. Their character is suggested by the deposits of flood wood that Coleman (5) found near Michipicoten, which he said were probably of Algonquin age, and certainly older than the Nipissing Lakes. They contained trunks recognized as poplar, cedar, balsam, white and black spruce, jack pine and white pine.

SUMMARY

This study is based on a summary report and analysis of all the records known to the writer of the occurrence of white and red pine north of a specified line in Ontario (12). It comprises a map showing the location and character of the stations, and a discussion of the actual distribution and mode of occurrence of those species at the northern limits of their range in the province.

The base line selected was the height of land between the Great Lakes and James Bay from the Quebec boundary westerly to a point near Missinibi; thence to Lake Superior at Michipicoten and along the shore to the head of Black Bay; thence westerly to the Canadian National railway and along that line to Sioux Lookout and the Manitoba boundary.

The distribution of white and red pine north of that line is seen to be referable to eastern and western sectors. In the region north of the central part of Lake Superior stations for white pine are unknown, and red pine is exceedingly rare. In the western zone red pine is commoner than white pine, while in the east and in the Nipigon area the reverse is true. The relative abundance of red pine increases toward the north throughout.

Red pine occurs typically in small stands on the coarser glacial deposits; white pine is usually scattered and is less selective with respect to site. Reproduction is exceedingly scarce, especially in the case of white pine.

The depth of the peripheral zone, in which white and red pine are sporadic or rare, appears to be generally more than one hundred miles. Within that zone many stations are virtually isolated and self pollination of the trees must be the rule. Early survey reports record the occurrence of pine at stations where it is now absent. The present condition of many white pine stands suggests that they are decadent.

The history of the glacial lakes in northern Ontario has been of prime significance relative to the actual distribution and age of the forests there. Highland areas, available for colonization at a relatively early date, have been forested much longer than the areas covered by the waters of Lakes Algonquin and Ojibway, and have doubtless contributed to the vegetation of the latter.

ACKNOWLEDGMENT

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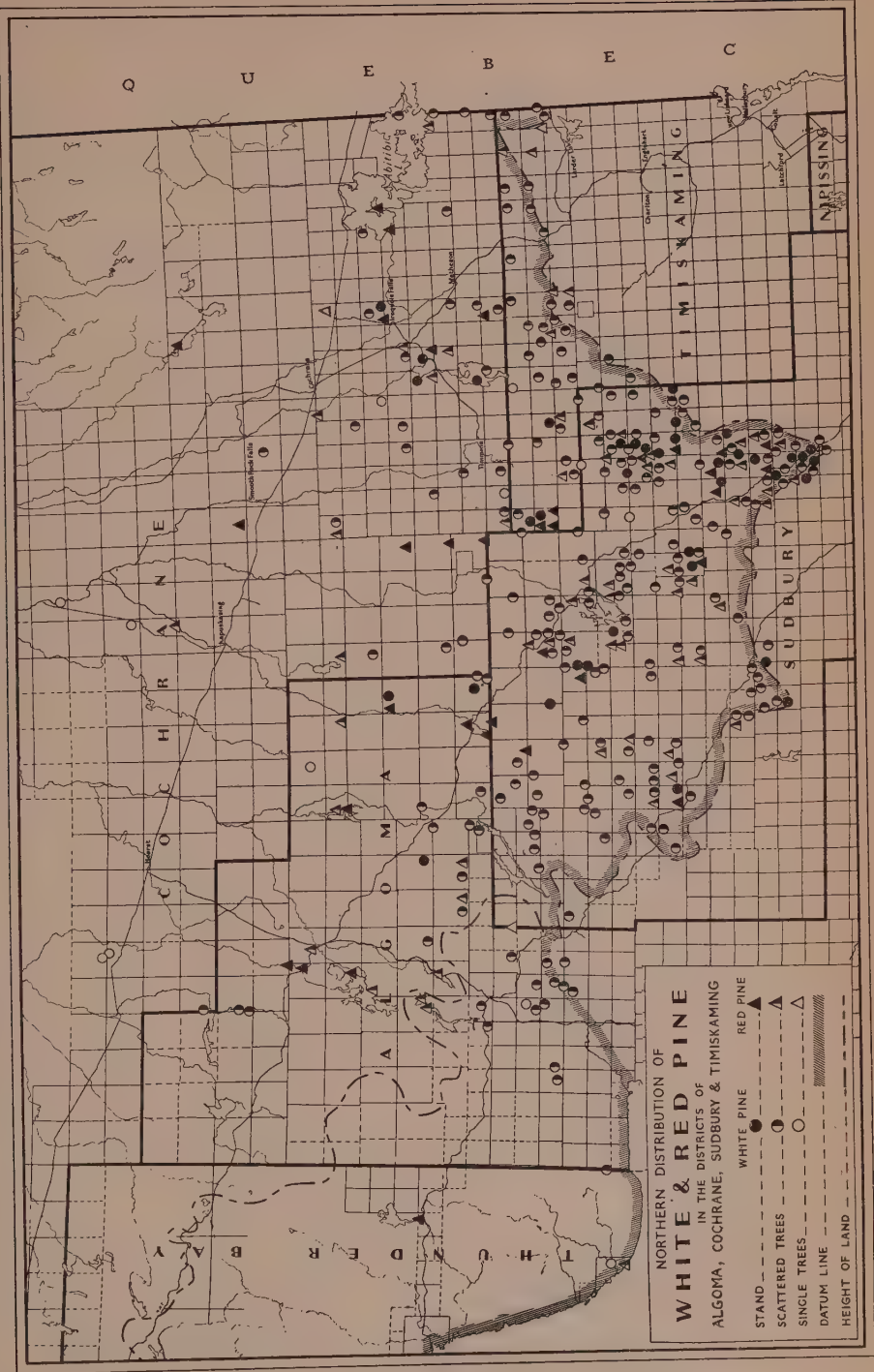
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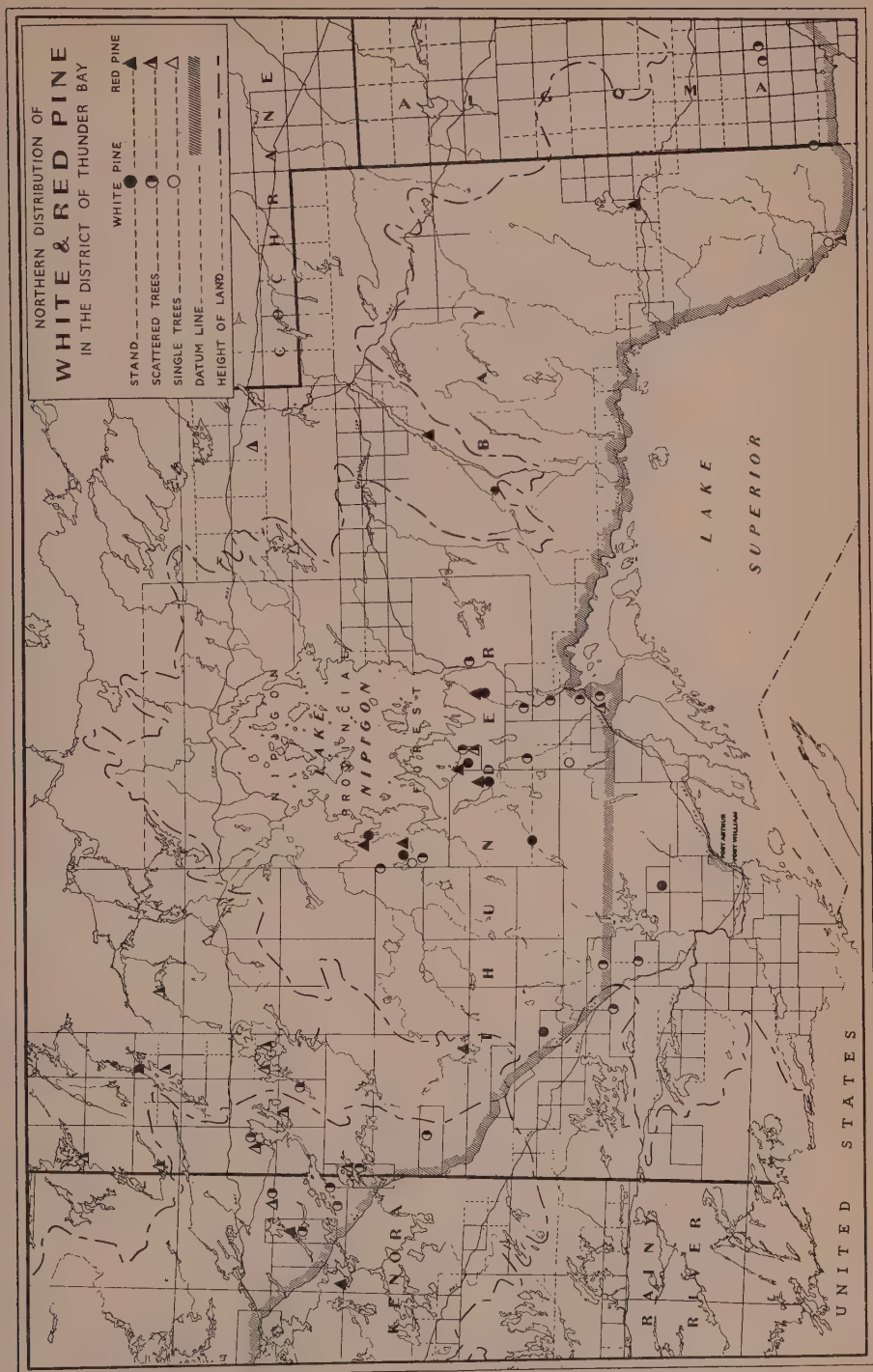
EXPLANATION OF PLATES I, II, AND III

Distribution of white pine and red pine at the northern limit of their range in Ontario. Eastern, central, and western parts respectively. Scale: 48 miles = 1 inch.

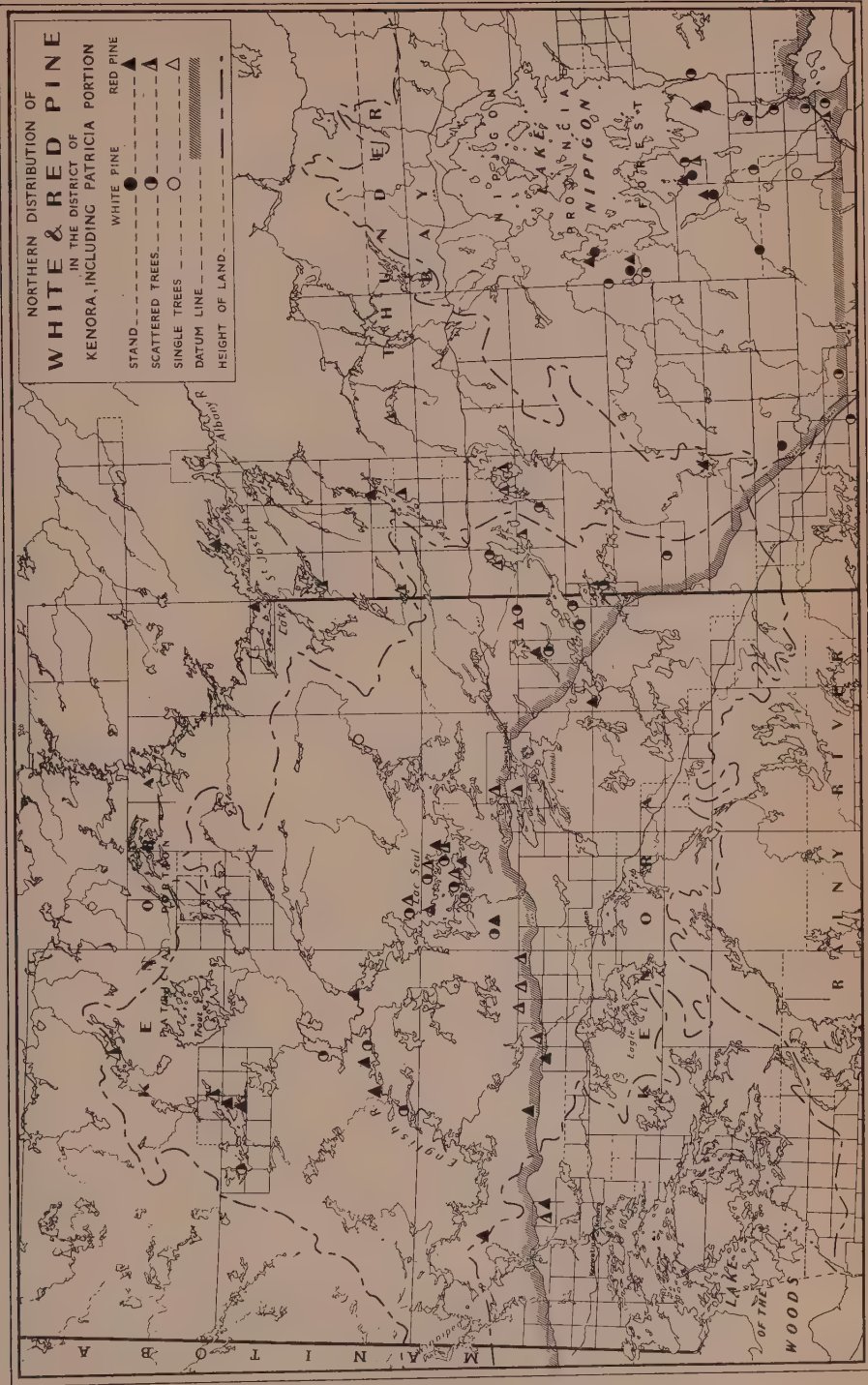
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DISTRIBUTION AND OCCURRENCE OF WHITE PINE AND RED PINE



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STUDIES IN THE BORAGINACEAE, XVI *
SPECIES CHIEFLY FROM MEXICO AND
WESTERN UNITED STATES

IVAN M. JOHNSTON

Cordia coyucana, sp. nov.

Frutex 3 m. altus ramosus; foliis 4–7 cm. longis 1.5–3 cm. latis 3–5 mm. longe petiolatis saepe infra medium latioribus, apice acutis, basi acutis obtusisve, margine in tertiam partim inferiorem integris alibi evidenter dentatis (dentibus 0.3–1 mm. altis), supra viridibus subvelutinis pilos majores gracilis mollis 1–2 mm. longos ascendentis basi incrassatos et pilos perinconspicuos minutos basi conico-incrassatos gerentibus, subtus griseis tenuiter tomentosis evidenter costatis et nervatis; inflorescentia capitato-congesta in ambitu elliptica densissima ca. 50-flora maturitate 10–13 mm. crassa 15–25 mm. longa; pedunculo 3–4 cm. longo extra-axillari e latere caulis erumpenti; calyce ad anthesin 4–5 mm. alto hispidulo, lobis triangularibus 1 mm. longis 1–2 mm. latis acutis nullo modo appendiculatis; corolla alba 6 mm. longa extus glabra intus in tubo villulosa, limbo ad 5 mm. diametro, lobis ca. 2 mm. longis et latis apice emarginatis margine crispatis; filamentis ca. 3 mm. supra basim corollae affixis ca. 2 mm. longis.

GUERRERO: Coyuca, shrub 3 m. tall, on hill, 1935, *Hinton 8156* (TYPE, Gray Herb.).

A very well marked species of the Section *Varronia*. It is readily distinguished from all known species by the following combination of characters: large very dense ellipsoidal capitate-congested pedunculate inflorescence, indument of simple (non-stellate) hairs, unappendaged calyxlobes, and small corollas. None of its congeners in Mexico or Central America seem closely related to it.

Cordia passa, sp. nov.

Planta laxa suffruticosa; ramis fruticosis gracilibus, juventate foliosis simplicibus 5–15 cm. longis 1–1.5 mm. crassis ascendentibus e caudice ramos procumbentis efoliatis composito erumpentibus; foliis 3–10 mm. distantibus 2–15 mm. longe petiolatis; lamina 15–55 mm. longa 5–30 mm. lata infra medium latiore, basi obtusa vel acuta, apice acuta, margine utroque conspicue 5–8-dentata, subtus grisea (pilis 0.2–0.7 mm. longis e basi pustulata inconspicua erumpentibus donata) utroque latere costae nerviis evidentibus ca. 5 donata, supra viridi hispidula (pilis ascendentibus ad 0.5 mm. longis e basi pustulata inconspicua erumpentibus donata); pedunculo extra-axillari 0.5–3 vel rariter ad 7 cm. longo; inflorescentia capitata densa 10–25-flora corollis exclusis 0.8–1.2 cm. diametro; calyce sub anthesi ad 5 mm. longo, lobis 2.5–3 mm. longis 1.2–1.5 mm. latis sparse hispidulis e basi sursum gradatim attenuatis apice viridibus subliberis; corolla alba infundibuliformi 2.5–2.8 cm. longa, limbo ad 2 cm. diametro, tubo parte inferiore 1 cm. longo 1–1.5 mm. crasso deinde sursum gradatim ampliato, lobis emarginatis ca. 8 mm. latis et 4 mm. longis; filamentis ad 5 mm. longis, antheris ad 1 mm. longis.

* No. XV in this series was published in this Journal, 21: 336–355. 1940.

TAMAULIPAS: Near San Lucas, Jaumave, July 1932, *Rozynski 563*. HIDALGO: Jacala, mountainside, 4500 ft., July 1939, *Chase 7461* (TYPE, Gray Herb.); Jacala, dry trailside at top of east wall of Barranca Seca, between Hilo Juanico and Pacula, fl. white, alt. 1400 m., Oct. 1946, *Moore 1823*. INDEFINITE: *Coulter 1332*.

A relative of *C. podocephala* Torr. of northeastern Mexico and adjacent Texas and occupying an area just south of that species. It is a sprawling plant with a large slender-tubed funnellform corolla with short broad lobes. Its calyx has a somewhat acuminate apex formed of the partially free tips of the lobes. On the other hand, *C. podocephala* is an erect-growing plant. Its smaller corollas have a short tube and a deeply lobed limb. and its calyx-lobes have no free tips. Though related, the species are undoubtedly distinct.

Bourreria Hintonii, sp. nov.

Frutex; ramulis horni ad 1.5 mm. crassis et 15 cm. longis pilulos rigidulos adpressos sparsissimos perinconspicuos 0.1–0.4 mm. longos gerentibus; foliis obovatis vel obovato-oblancoelatis 2.5–6 cm. longis 1–3 cm. latis supra medium latioribus deinde deorsum in petiolum 2–4 mm. longum supra sparse minuteque hispidulum attenuatis, margine anguste revolutis, subtus glaberrimis nullo modo asperatis, supra scabridis pilos sparsos inconspicuos rigidos perbrevis antrorse ascendentis basi silicosa erumpentis proferentibus, nervis primariis utroque latere costae subtus prominentis supra infra medium impressae prominulis 5–7 cum nervis secundariis et tertiariis conjunctis; cymis 5–10 mm. longe pedunculatis breviter furcatis sparsifloris; calyce 7–9 mm. longo, basi ca. 2 mm. crasso breviter crassequae substipitato, apice 3–4 mm. crasso, extus fere glabro sub lente pilis minutis sparsissimis praedito, intus supra medium plus minusve striguloso, lobis inaequalibus 2–3 mm. longis 1–1.5 mm. latis acutissimis erectis; corolla alba 2 cm. longa, limbo ca. 14 mm. diametro, lobis rotundis 5–6 mm. longis ad 5 mm. latis supra glandulis substipitatis minutissimis sparse praeditis extus sub lente glandulis et pilulis minutissimis sparse obsitis; tubo calycis 10–12 mm. longo basi 2 mm. crasso, apice ad 5 mm. crasso, intus glabro, extus apicem versus sparse minuteque glandulifero; antheris subexsertis 4 mm. longis; filamentis glabris 4 mm. longis ca. 3 mm. infra sinus affixis; ovario glabro; fructu ignoto.

GUERRERO: San Luis, dist. Galeana, shrub by beach, also a tree inland, fl. white, Oct. 1937, *Hinton 10866* (TYPE, Gray Herb.).

A well-marked species of uncertain affinities. Among its notable features are its moderately small leaves very scabrous above, its sharply toothed elongate calyx strigose only inside and merely substipitate at base, its glabrous filaments, and its elongate exserted corolla-tube.

Bourreria longiflora, sp. nov.

Arbor 10 m. alta; foliis glaberrimis ellipticis 5–11 cm. longis 3–6 cm. latis 8–20 mm. longe petiolatis ubique obtusis supra sublucidis subtus opacis, nervis primariis utroque latere costae subtus prominentis ca. 9 prominulis cum nervis secundariis et tertiariis transverse conjunctis; cymis 3–10-floris congestis apice ramulorum 1–5 cm. longorum extra-axillarum paucifoliorum gestis, bracteis ovatis ad 8 mm. longis deciduis conspicue ciliatis; calyce sub anthesi campanulato ad 8 mm. longo extus glaberrimo intus supra medium dense conspicueque albo-villuloso, lobis triangularibus

acutis 2.5–3 mm. longis 2 mm. latis; corolla alba odorata ca. 25 mm. longa glaberrima, tubo ca. 20 mm. longo a basi 3 mm. crasso sursum gradatim ampliato apice 7–9 mm. crasso, faucibus haud differentiatis, lobis circularibus ca. 6 mm. diametro ascendentibus limbum ca. 15 mm. diametro formantibus; staminibus exsertis, filamentis 20–25 mm. longis ca. 6 mm. supra basim tubi affixis infra medium evidente villulosis; antheris 4 mm. longis medio affixis; fructu ignoto.

MICHOACAN: Tizupan, dist. Coalcoman, tree 10 m. tall, in barranca, fls. white, sweet-scented, 1941, *Hinton 15908* (TYPE, Gray Herb.).

A well-marked species perhaps most closely allied to *B. Rekoii* Standley of Oaxaca. From that species it differs in having glabrous obtuse leaves, elongate corolla with exserted tube, and also a smaller calyx with shorter teeth, glabrous outer surface, and practically non-stipitate base.

Bourreria panamensis, nom. nov.

Bourreria superba, var. *glabra* Schery, Ann. Mo. Bot. Gard. 29: 366 (1942).

A plant known only from a suite of collections made near Chiriqui Lagoon, prov. Bocas del Toro, in northwestern Panama, *Wedel* nos. 2472, type, 1949 and 1974. It shows many similarities with *B. superba* Johnston of western Mexico (Guerrero and Michoacan), but since it differs consistently in many details and comes from a region not only with a different climate but also geographically far removed from that of its relative, it seems best to give it specific recognition. Among the characters distinguishing *B. panamensis* are its glabrous twigs, its glabrous more elongate leaves, its glandular rather than hairy filaments, its shorter and broader anthers, and its shorter and stouter corolla-tube. Its calyx is not densely strigose inside but is glabrous except for some minute hairs on the lobe-margins. Its style is about half as long as that of its relative. As with *B. superba* its fruit remains unknown.

Heliotropium confertifolium Torr. var. *coldenioides*, var. nov.

Differt a varietate typica planta caespitosa vel prostrata; ramulis foliiferis strigosis saepe griseis (pilis contortis ascendentibus haud gestis); foliis et sepalis basim versus sparse strigosis sed margine evidenter ciliatis.

COAHUILA: Zacate near Muzquiz, *Marsh 521*; near La Azufrosa, Sept. 22, 1848, *Gregg 509*; base of hills near Saltillo, 1905, *Palmer 523*. NUEVO LEON: 11 mi. south of Sabinas Hidalgo, *Muller 2630*; east of Cerralvo, May 29, 1847, *Gregg*; Marin, Dec. 1852, *Thurber*; Monterrey, June 22, 1848, *Gregg 180*; Monterrey, *Dr. Edwards*; canyon 12 mi. west of Monterrey, *Painter & Barkley 14247*; Montemorelos, *Shreve & Tinkham 9816*; Linares, *Lundell 7284*; Marguerita, south of Monterrey, *Hitchcock & Stanford 6863*. TAMAULIPAS: San Carlos, *Berlandier 3199*; 4 km. west of Miquihuana, *Stanford et al. 744* (TYPE, Gray Herb.). SAN LUIS POTOSI: Rio Verde, stony ridge, 1904, *Palmer 5*; Minas San Rafael, 1911, *Purpus 4862A*; without locality, 1878, *Parry & Palmer 616*.

The present variety is the eastern form of the species and is best developed east of the Sierra Madre Oriental. Ranging south at low altitudes in Tamaulipas and Nuevo Leon it reaches eastern San Luis Potosi, and accordingly much further south than typical *H. confertifolium*. It is a prostrate or distinctly caespitose plant and does not develop the erect or ascending leafy stems of the typical form of the species. Its stems are

strigose and usually sparingly so, and are not clothed with both appressed hairs and abundant short contorted ones as in true *H. confertifolium*. The leaves and sepals are usually very sparingly strigose on the inner face especially below the middle, and their margins, especially towards the base, are evidently ciliate. In the erect-growing typical form of the species the leaves and sepals are densely clothed with appressed hairs and their margins are not noticeably ciliate. In general habit our plant much resembles species of *Coldenia* of the section *Eddya*.

Torrey, Bot. Mex. Boundary 138 (1859), apparently distinguished our plant from what was later called *H. confertifolium*, but mistakenly identified it as "*H. limbatum* Benth." Typical *H. confertifolium* Torr. ex Gray was first described as *H. limbatum* var. *confertifolium* Torr., l. c. It was based upon five collections: Leon Springs, Pecos Co., Texas, *Bigelow*; San Vicente, Coahuila, *Parry*; Cerralvo, Nuevo Leon, *Gregg*; Devils River, Val Verde Co., Texas, *Wright 481*; and hills of the Pecos, Pecos Co., Texas, *Wright 1547*. The Gregg specimens represent the variety *coldenioides*, but the remaining ones are all typical *H. confertifolium*. True *H. confertifolium* is known north of the Mexican boundary only in Texas where it has been found in Brewster, Pecos, Terrell, Val Verde, Maverick, Webb, Zapata, Starr and Hidalgo counties. In Mexico it occurs near the Rio Grande in northern Tamaulipas but extends far south into that country only in the state of Coahuila. One collection is at hand from extreme southeastern Chihuahua. In Coahuila it is scattered in occurrence and at many places seems to favor gypseous soils, especially those associated with beds of Upper Cretaceous age. Forms transitional to the variety *coldenioides* are found in Coahuila only at low altitudes in the eastern parts of the state.

***Heliotropium queretaroanum*, sp. nov.**

Planta 2-4 dm. alta basim versus fruticosa; ramis foliiferis gracilibus sparse ramosis vel simplicibus 0.5-1 mm. crassis sparse strigosis (pilis 0.5-0.8 mm. longis pallidis donatis) internodiis 0.3-2 cm. longis; foliis 1-2 (-2.5) cm. longis 0.5-2.5 mm. latis linearibus vel anguste lanceolatis inconspicue costatis haud nervatis margine planis vel evidenter revolutis apice acutis basi in petiolum ca. 1 mm. longum contractis, facie superiori viridibus inferiori pallidioribus utrinque sparse strigosis; inlorescentia gracili racemosa secunda ebracteata laxiflora 5-10 cm. longa; calyce sub anthesi 2.5-3 mm. longo praesertim basim versus strigoso, lobis subulatis inaequilongis, pedicello 0.5-2 (-3) mm. longo; corolla alba ad 6 mm. longa, tubo extus strigoso, lobos calycis haud superanti, limbo 3-5 mm. diametro, lobis ovatis apice obtusis; nuculis 4, dorse alte convexis plus minusve villulosis; stylo quam stigmatibus 2-3-plo breviori; stigmatibus subulato ad 0.8 mm. longo.

QUERÉTARO: Near Higuerillas, Aug. 23, 1905, *Rose, Painter & Rose 9800* (TYPE, U. S. Nat. Herb.); Ciervo, Cerro de la Mesa, Aug. 20, 1905, *Altamirano 1589* (US).

A species very closely related to *H. angustifolium* Torr. and one occurring in a detached area well beyond the southern limits of that species. Its relative is a small bush with stiff woody stems and branches, and has linear leaves 1 mm. wide or less and corollas that have acute lobes. The

flowers are borne in usually abbreviated crowded racemes which at most reach only 5 cm. in length. The proposed species is noticeably different in habit of growth, leaf-width, length of inflorescence, and shape of corolla-lobes. Its slender, weak, elongate, somewhat flexuous stems are ascending and spring from a scanty fruticulose caudex formed of the persisting basal portion of stems of the previous season. The leaves of the Querétaro plant are obviously larger and broader than those of its northern relative. Its inflorescences are conspicuously more elongate and abundantly and loosely flowered, even at anthesis being 5–10 cm. long. Its corolla-lobes are somewhat broader and are obtusish rather than acute or subulate.

Heliotropium texanum, sp. nov.

Herba annua erecta 1–3 dm. alta sparsiramosa; caule 1–1.5 mm. crasso sparse antrorseque strigosis (pilis pallidis ad 0.5 mm. longis donatis); ramis ascendentibus simplicibus ad 2 dm. longis; foliis pleraque alternis sed infimis 1–2 oppositis; lamina costata sed enervata viridi strigosa oblanceolata vel lanceolata 1–2 cm. longa 2–7 mm. lata, apice acuta, basi in petiolum 2–5 mm. longum attenuata, margine plus minusve revoluta; inflorescentia secunda multiflora elongata racemosa, fructifera ad 1 dm. longa bracteis foliaceis sparse ornata; calyce sub anthesi ca. 3 mm. longo ad 1 mm. longe pedicellato strigoso, fructifero ca. 5 mm. longo 1–2 mm. longe pedicellato, lobis 0.5–1 mm. latis inaequilongis lanceolatis; corolla alba infundibuliformi 8–10 mm. diametro, tubo ca. 3 mm. longo extus sparse strigoso, faucibus intus villulosis, lobis limbi 5 ovatis 2–3 mm. longis 2–2.5 mm. latis apice rotundis, sinibus latis plicatis fundite quisque lobulo triangulari 0.2–0.5 mm. alto donatis; antheris ca. 0.9 mm. longis apice cohaerentibus acutis hispidulis; filamentis perbrevibus ca. 1.5 mm. supra basim corollae affixis; ovario glabro; stylo 0.8–1 mm. longo; stigmatibus ca. 0.7–0.9 mm. longo elongato attenuato basi annulato incrassato ad 0.3 mm. diametro; fructu villuloso 1 mm. alto; nuculis 4 homomorphis, dorse alte convexis pilis mollibus erectis non rariter apice uncinatis vestitis, ventre angulatis faciebus fovea circulari conspicua donatis.

TEXAS: South of San Antonio, *Rose & Russell 24144*; 10.5 mi. NW of Falfurrias, Duval Co., 1935, *Cory 14746*; 8.3 mi. NE of Riviera, Kleberg Co., 1935, *Cory 17082*; Kenedy Co., June 26, 1941, *Tharp*; 3 mi. S of Sarita, King Ranch, Kenedy Co., on sandy plain, erect, corolla white with a yellow-orange eye, Oct. 1946, *Lundell 14721* (TYPE, Gray Herb.).

An annual species related to *H. assurgens* Johnston, of western Mexico. It differs in having a slightly coarser, lower, and less branched habit of growth, very much larger corollas, and fewer-flowered inflorescences. At the base of the broad sinus between the corolla-lobes there is usually a triangular lobule, in form generally broader than long, and in most cases proportionately better developed than in the corollas of *H. assurgens*. The plant at first glance bears some resemblance to the Texan *H. convolvulaceum* var. *racemosum* (Rose & Standley) Johnston and has actually been confused with it. The resemblance, however, is purely superficial, since the plants are not even closely related and, furthermore, differ in a host of details in flower and fruit structure.

Heliotropium Wigginsii, sp. nov.

Herba annua 1-4 dm. alta simplex vel sparsissime ascendenteque ramosa; caule 1-1.8 mm. crasso pilis pallidis rigidulis ca. 0.5 mm. longis antrorse adpressis sparse vestito; ramis 0-3, simplicibus 5-20 cm. longis; foliis basim versus caulis oppositis ceteris alternis saepissime 1-3 cm. distantibus; lamina oblanceolata 1-4 cm. longa 2-6 mm. lata supra medium latiori deinde basim versus in petiolum 1-3 mm. longum gradatim attenuata costata sed enervata, margine plana vel plus minusve revoluta, supra viridibus, subtus subpallida, facie utrinque strigosa (pilis pallidis rigidulis ca. 0.5 mm. longis basi pustulatis donata); inflorescentia secunda racemosa maturitate 1-3 dm. longa infra medium bracteis foliaceis 1-2.5 cm. longis ornata, supra medium bracteis inconspicuis subulatis 1-10 mm. longis gesta; calyce ad anthesin ca. 3 mm. longo apicem tubi corollae attingenti, lobis subaequilongis sparse strigosis margine rigido-ciliatis; calyce fructifero 0.7-1.2 mm. longe pedicellato, lobis cuneatis vel lanceo-cuneatis; corolla alba conspicua infundibuliformi extus sparse strigosa plus in faucibus villulosa alibi glabra; limbo 10-15 mm. diametro; lobis oblongis ad 6 mm. longis et 3 mm. latis apice obtusis, sinibus latis profundis plicatis fundite quisque lobulo 1-1.5 mm. longo triangulari apice caudato incurvato donatis; antheris ad 12 mm. longis apice encrassatis truncatis villulosis haud cohaerentibus; filamentis ad 0.2 mm. longis ca. 1.5 mm. supra basim tubi corollae affixis; ovario glaberrimo; nuculis 4 homomorphis glabris ad 2 mm. altis, dorso alte convexis medium versus plus minusve rugosis et tuberculo prominulo donatis, ventre angulatis in utroque facie marginem versus fovea parva elliptica donatis, apice in rostrum erectum compressum breve abrupteque attenuatis.

SONORA: 8 mi. west of Hermosillo on road to Kino Bay, near rain pools in clay on mesquite-covered flat, Aug. 27, 1941, *Wiggins & Rollins 115* (TYPE, Gray Herb.); 19 mi. north of Colorado, between Colorado and Mazatán, gentle gravelly grassy slope, Sept. 7, 1941, *Wiggins & Rollins 355*. BAJA CALIFORNIA: 5 mi. north of Comondú, open plateau thickly strewn with lava rocks, Oct. 3, 1941, *Hammerly 169*.

An erect, sparingly branched annual species with very distinctive corolla and fruit. The attractive white corollas have 5 large oblong lobes separated by broad, deep, plaited sinus. A distinct lobule arises from the bottom of each sinus. This lobule, usually folded, is triangular when spread and is contracted at the tip into a short strap-shaped incurving apical appendage. The spread corolla of the species, accordingly, appears to have a limb made up of alternating large and small lobes. The nutlets are entirely glabrous. Each has a high convex back that is usually somewhat ridged and above the middle is puckered up into a teat- or wart-like protuberance. The nutlet-tip is slightly prolonged, flattened, and upturned. The inner faces of the nutlet each bear a rather small, elliptic, submarginal perforation. The species is very well marked. I can suggest no close relative.

Macromeria guatemalensis, sp. nov.

Planta perennis multicaulis suffruticosa 3-15 dm. alta scabrida; ramis hornotinis viridibus foliatis ad 5 mm. crassis subsimplicibus vel ramulos axillaris ascendentes pluris ad 1 dm. longos gerentibus hispidis et minute adpressequ pubescentibus (pilis majoribus 1-2 mm. longis erectis rigidis

e basi bulbosa orientibus, minoribus 0.2–0.8 mm. longis antrorse adpressis); ramis et ramulis annotinis delapsu foliorum denudatis non rariter decorticatis apice ramulos foliatis novellos ad 2 dm. longos proferentibus; foliis lanceolatis 2.5–5 cm. longis 6–15 mm. latis subsessilibus vel ad 1 mm. longe petiolatis, apice attenuatis, basi rotundis ad acutis, margine anguste revolutis, supra viridibus venis et costa impressis evidenter notatis bases pilorum antrorse adpressorum rigidorum abundantium 0.2–0.8 mm. longiorum silicosas tuberculatas vel subconicas persistentis gerentibus, subtus griseis costa et venis salientibus donatis pilos gracilis adpressos 0.8–1.2 mm. longos pallidos e basibus pustulatis orientis juventate abundantis maturitate sparsiores proferentibus; floribus apicem versus ramuli gestis; calyce ad anthesin 1 cm. longo 3–8 mm. longe pedicellato, lobis inaequalibus linearibus ca. 1 mm. latis prominenter costatis bases pustulatas pilorum gracilium 0.4–0.8 mm. longorum ascendentium abundantis gerentibus; corolla lutescenti ca. 3.5 cm. longa extus hispidula intus glabra, tubo parte basali ca. 10 mm. longa 1–1.2 mm. crasso deinde sursum abrupte expanso, parte superiore cylindrico ca. 17 mm. longo ca. 5 mm. crasso; lobis corollae triangularibus 6–8 mm. longis 5–6 mm. latis summum ad apicem rotundis; filamentis 4–7 mm. longis ca. 3 mm. longe sub altitudinem sinus affixis; antheris 2.5–3 mm. longis elongatis oblongis medio-affixis; stylo filiformi exserto; nuculis albis osseis levibus ovoideis ad 3 mm. longis.

GUATEMALA: Above San Juan Ixcay, Sierra Cuchumatanes, dept. Huehuetenango, 2400 m., high bluff in upper reaches of barranco, subligneous and bushy, 1–3 ft. tall, corolla pale yellow, "te de monte," infusion of leaves used for colds, *Steyermark 50069*; dry upper southfacing slope of Volcan Tajumulco, between Las Canoas and top of ridge, 7 mi. from San Sebastian, dept. San Marcos, erect herb 4–5 ft. tall, fl. with yellow tube and green lobes, lvs. stiff, dull green above, gray beneath, "etama real," fruit used for "los cuentas," *Steyermark 35898* (TYPE, Gray Herb.).

A new species of a genus heretofore unknown from south of Mexico. It is related to *M. Pringlei* Greenm. of southern Mexico (Hidalgo, Guerrero and Oaxaca). Unlike its relative it has strong stems that become somewhat woody and function for at least two seasons. The hairs on the plant have excessively developed siliceous bases. They almost pave the upper leaf-surfaces and make the stems verrucose. The calyx-lobes are prominently ribbed and are rough with numerous hair bases. The corolla averages distinctly smaller than in *M. Pringlei*.

Dasynotus, gen. nov. Boraginaceae-Boraginoidearum.

Calyx 5-partitus longe pedicellatus segmentis elongatis in statu fructifero fere duplo accrescentibus donatus. Corolla hypocraterimorpha conspicua glabra; lobi 5 elliptico-oblongi imbricati patentes; tubus cylindricus calyce brevior, intus fere ad basim appendiculas 10 minima tumescentes gerens; fauces inconspicuae angustae abrupte expansae. Fornices corollae fundus faucium orientes magni exserti ligulati supra medium extrorse recurvati apice pendenti conspicue breviterque bilobati, medium versus puberulenti, apicem versus minute papillati, infra medium margine minute ciliolati. Stamina 5 inclusa fere ad apicem tubi corollae affixa; filamenta brevica compressa attentuata; antherae anguste oblongae obtusae paulo infra medium affixae. Ovarii lobi 4 distincti in gynobasi pyramidalis oblique affixi. Stylus filiformi-subulatus apice gynobasis inter apices nuculearum gestus a nuculis liber; stigma simplex disciformum minimum. Gynobasis maturi-

tate cartilaginea late pyramidalis magna excavationibus conspicuis ovatis apice attenuatis crasse marginatis ornata. Nuculae 4 conformes late ascendentes ovatae dorsi-ventraliter compressae laeves pro tribo Eritrichiae magnae, facie dorsali pilis albis simplicibus erectis gracilibus abundantibus obsitae margine erecto vel ascendenti angusto humuli inermi cinctae, facie ventrali glabrae cicatrice majusculo convexo prominulo medio vel paulo supra medium donatae in tertiam partem superiorum prominenter carinatae alibi valde convexae. Semina recta supra medium lateraliter affixa, cotyledones planae indivisae, radícula superior. — Herba perennis multicaulis erecta semi-metralis viridis. Folia alterna oblanceolata. Cincinni terminales pauci laxi sparsiflori solum basim versus paucibracteati. Pedicelli elongati maturitate saepe deflexi tandem basi ima disarticulati. — Nomen elongatur a *δαρσιν* (hispidum) et *ὄστρον* (dorsum), quia nuculae dorse hispidulosae sunt.

Dasynotus Daubenmirei, sp. nov.

Herbae radice perenni valida oriens; caulibus numerosis fistulosis erectis ad 5 dm. altis simplicibus foliosis 2–5 mm. crassis sparse hispidulosis (pilis 0.5–2 mm. longos gerentibus); foliis caulinis infimis reductis, ceteris 1–2 cm. distantibus oblanceolatis evidenter costatis 9–13 cm. longis 1.5–3 cm. latis supra medium latoribus deinde basim sessilem 2–4 mm. latum versus attenuatis, ubique pilos 0.5–1.5 mm. longos antrorse appressos vel ascendentes non rariter e basi plus minusve pustulato haud conspicuo erumpentes vix abundantes gerentibus, subtus pallidioribus nervos primarios utroque laterae costae 5 gestos haud ramosos graciles inconspicuos proferentibus; inflorescentia apice caulis gesta racemosa laxissima basim versus folios parvos 1–2 ad 6 cm. longos et 1.5 cm. latos proferenti alibi ebracteata, rhachi in statu fructifero ad 10 cm. longa flores 0–3.5 cm. distantes gerenti; pedicellis sub anthesi 1–2.5 (–3) cm. longis erectis mox divaricatis vel decurvatis, maturitate divergentibus vel basi deflexis et tandem ibique disarticulatis; calyce plus minusve strigoso, lobis cuneatis vel cuneato-lanceolatis acutis sub anthesi 6–8 mm. longis 1–1.5 mm. latis erectis, fructiferis ad 14 mm. longis et infra medium ad 3 mm. latis evidenter costatis ascendentibus; corolla alba ad 22 mm. diametro, tubo 4.5–5 mm. longo 4–4.5 mm. diametro, lobis 6.5–8 mm. latis 8–9 mm. longis apice rotundis; fornicibus ad 4 mm. longis supra medium ad 0.8 mm. latis deinde deorsum basim 1.5–1.7 mm. latum versus latoribus, apice pendenti bilobulata 0.5 mm. profunde emarginatis; filamentis ad 1 mm. longis ca. 1 mm. infra apicem tubi corolla affixis, antheris 1.5–2 mm. longis; stylo 3–5 mm. longo; nuculis saepissime 4 ascendentibus 5–6 mm. longis 4–4.5 mm. latis 2–2.5 mm. crassis in ambitu late ovatis, facie exteriori dense hispidulosis (pilos 0.5–0.9 mm. longos uniloculares gerentibus) maturitate interdum subglabrescentibus margine rugae angustae 0.2–1 mm. altae erectae glabrae circumdatis, facie interiori sublucentibus cicatrice centrali vel supra centrali 1–1.2 mm. longa ad 1 mm. lata donatis; gynobasi fructiferi 2 mm. alta basi ima 3–4 mm. diametro deinde sursum abrupte contracto pyramidali, faciebus pyramidis sub angulo 40° inclinatis excavationes basi 1–1.5 mm. latos supra medium abrupte contractos gerentibus.

IDAHO (Idaho Co.): Moist roadside in draw, vicinity of Walde Mt. L. O., open place in spruce-fir zone, June 24, 1945, *R. F. Daubenmire 4535*; near Walde Mt. L. O., July 14, 1945, *R. F. Daubenmire 45131*; near Walde Mt. L. O., clearing in forest, July 24, 1946, *R. F. Daubenmire 46289* (TYPE, Gray Herb.).

The discovery of a plant representative of a new genus is always of interest. The recent discovery in the mountains of Idaho of this new monotype is not merely interesting but also a surprise. Among North American Boraginaceae well-marked new species continue to turn up from time to time, but with the sole exception of *Mimophytum* (a Mexican monotype discovered in 1905) all the hitherto recognized American genera have had representatives known to science for at least a century. The prospects have been that the only additional genera recognized would result from the segregation of old concepts or from the possible discovery of a new species set off from some old genus by one or more striking characters that might possibly justify the erection of a new genus. The discovery in Idaho of a new borage which is not merely a very well marked species obviously derived from some recognized genus, but rather a wholly new generic type of very uncertain relationships, is accordingly unexpected. The plant is so distinct, in fact, that, had it been presented to me devoid of geographical data, I would have failed to recognize it as American; I would probably have guessed that it was another one of those very distinct new genera that are from time to time detected in southeastern Asia. As a matter of fact, however, it is no more closely related to the Asiatic Boraginaceae than to the American ones.

In the system of genera the new genus seems best placed near *Hackelia* and *Eritrichium*, preferably just before the former. The plant in gross habit rather suggests *Hackelia* but is very different in inflorescence, nutlets, and faucal appendages. Only in a few details of nutlet structure does it much suggest *Eritrichium*.

The inflorescence of *Dasynotus* is a very loose racemose cyme of slenderly long-pedicellate flowers. In general appearance it is somewhat reminiscent of that of *Borago officinale* L., and so very different from the slender, elongate, secund, racemose flower-clusters of *Hackelia*. The pedicels may become very elongate and are spreading, decurved, or basally abruptly deflexed. At extreme maturity they disarticulate at the very base.

The faucal appendages are certainly unusual and apparently unique in the family. They are about 4 mm. long, ligulate, swollen, and above the middle gracefully and outwardly decurved with the pendent end distinctly cleft. The margin below the middle is ciliolate. The surface of the middle section is pubescent. On the arched outer portion of the appendage the minute pubescence becomes reduced and towards the distal end represented only by very minute papillae. Faucal appendages in some borage genera curve inward and partially close the throat of the corolla. The appendages of *Dasynotus*, however, are not only strongly decurved but they arch outward over the base of the corolla-lobe.

Seated on the cartilaginous pyramidal gynobase the nutlets of *Dasynotus* ascend at a wider angle and protrude more basally than is customary in members of the tribe *Eritrichieae*. In these details the plant simulates members of the *Cynoglosseae*. The nutlets of *Dasynotus*, however, are free from the style, devoid of appendages, and have a central (not apical)

attachment scar, all important details that clearly ally it with the *Eritrichieae*.

The individual nutlets are thickish but distinctly dorsi-ventrally compressed. They are broadly ovate in outline and are 5–6 mm. long and so large for one of the *Eritrichieae*. Ventrally they have a slightly protrudent, convex, ovate, central or somewhat supra-central attachment scar, and above the latter a prominent short ventral keel. The keel, formed of unbroken pericarp and bearing no groove nor thickened tissue, is distinctly elevated above the level of the scar. Except for the keel on its upper third most of the ventrum is convex. It is rather smooth, somewhat lustrous, and light in color. In general plan the ventrum of these nutlets is reminiscent of that in the nutlets of *Plagiobothrys* Sect. *Euplagiobothrys*. I doubt, however, if this resemblance can have any phylogenetic significance.

The dorsal surface of the nutlets of *Dasynotus* is nearly flat or slopes very gently on either side of the medial line. It bears an abundance of slender, white, single-celled hairs that are at first straight and vertical but later may become bent and disarranged. These hairs are neither hooked nor barbed. There may be a very slight swelling on the pericarpial surface where each is attached. When they fall away, as may happen on very old nutlets, the surface of the ventrum may accordingly be very obscurely and minutely tuberculate. Surrounding the hairy ventrum, like a tiny wall about a miniature grainfield, is a narrow glabrous elevated flange that rises vertically all around the margin. This erect flange is a tight projecting fold or wrinkle of pericarpial tissue. It is not differentiated in texture, color, nor surface from tissue adjoining, and has an even height and bears absolutely no appendages, teeth, or any sort of roughenings. It is accordingly very different from the marginal ridge in the nutlets of *Hackelia* and *Lappula*. Among the Boraginaceae nutlets with a dorsum simulating that in *Dasynotus* are to be found only in certain species of *Eritrichium*. In most species of the latter genus the nutlets have a toothed margin, but in some, e. g., *E. elongatum* (Rydb.) Wight of the northern Rocky Mts., the margin is unarmed, even, and seemingly only a protruding wrinkle in the pericarp, much as that found in the nutlets of *Dasynotus*. Also interesting is the fact that some Asiatic species of *Eritrichium* also bear numerous erect straight hairs on the margined dorsum of their nutlets. As a general rule most species of *Eritrichium* have a smooth lustrous pericarp rather similar to that found in *Dasynotus*. The similarities mentioned possibly may be indicative of some relationship between the two genera, though certainly it cannot be a very close one. *Dasynotus* and *Eritrichium* differ in habit of growth, inflorescence, and flower structure, as well as in form, scar, and ventral keeling of nutlets.

The region in Idaho where *Dasynotus* grows is one that exploration during the past decade has shown to be not only rich in local endemics but also notable for outlying inland congregations of species formerly thought to be confined to the coastal mountains of Oregon and Washington. Dr.

Daubenmire's discovery there of *Mertensia bella* Piper, formerly thought to be confined to the Siskiyou region of adjacent Oregon and California, is an example of this.

The particular place where the new genus was discovered lies 65–70 miles ESE from Lewiston in the watershed of the Lochsa River and about 5–10 miles northerly from the town of Lowell at the junction of the Lochsa and Selway rivers. It is in Idaho County near the northern boundary of Nez Perce National Forest and in the vicinity of Walde Mt. Lookout. On July 24, 1946, Professor Daubenmire made the following notes to accompany his no. 48289, the type collection: "A few plants observed in near-climax arborvitae forest 7.6 mi. east of Waldo Lookout on road towards Frenchman Butte. Plants growing in dense shade send up only a few stems from the crown. Those growing along trails and on cleared areas are much more robust. Eighty-nine stems were counted on one individual, these making a cluster about 25 cm. in diameter at the soil surface. The color of the corollas is pure white." Judging from the collections available the plant appears to flower in June and fruit in July.

Hackelia longituba, sp. nov.

Herba perennis 5–10 dm. alta pilis gracillimis mollibus brevibus adpressis incano-pubescentibus; foliis inferioribus oblanceolatis ad 15 cm. longis 10–18 mm. latis, infra medium in petiolum 2–3 mm. latum gradatim attenuatis, apice acutis, facie superiori medio costatis sed enervatis, facie inferiori pallidioribus obscure nervatis; foliis caulinis superioribus lanceolatis sessilibus numerosis saepissime 2–3 cm. distantibus ascendentibus majoribus supra basim 8–12 mm. latis, basi rotundis vel subcordatis, apice acutis; inflorescentia sub anthesi densiflora subcylindrica 3–4 cm. crassa 3–9 cm. longa, fructiferi laxa ramulis 6–15 cm. longis ascendentibus laxae 3–10-floris gestae; pedicellis ad anthesin 3–5 mm. longis, fructiferis ad 12 mm. longis; lobis calycis pilis adpressis mollibus incano-pubescentibus, sub anthesi 2–3 mm. longis 0.5–1.2 mm. latis oblongis vel cuneato-oblongis erectis, fructiferis reflexis triangularibus ad 2 mm. latis; corolla infundibuliformi caerulea, limbo 10–15 mm. diametro, tubo cylindrico conspicuo 2–3 mm. crasso 5–7 mm. longo quam lobis calycis duplo longiori, lobis ascendentibus late obovatis 5–7 mm. latis, appendiculis faucium erectis ad 2 mm. altis apice revolutis et conspicue transverseque dialatis pubescentibus subprotrudentibus; filamentis medio tubi affixis 0.2–0.5 mm. longis; nuculis 4 ovatis (sine aculeis ad 5 mm. longis) margine dorsoque aculeos 2–2.5 mm. longos apice glochidiatos saepissime distinctos armatis, cicatrice ovata.

CALIFORNIA: Leland Meadow, Tuolumne Co., 1940, *Quick 5*; Fahey Meadow, Tuolumne Co., 1935, *Quick 1449*; 3 mi. NE of Grohl, Tuolumne Co., 1935, *Roseberry 262*; Big Tree Grove, Calaveras Co., 1884, *Ball*; Big Tree Grove, *Mann*; near Big Trees, 1940, *Eastwood & Howell 8593* (TYPE, Gray Herb.); Camp Echo, El Dorado Co., 1915, *Heller 12185*; Fallen Leaf Lake, Tahoe Region, 1906, *Eastwood 1047*; Lake Valley, Tahoe Region, 1911, *Abrams 4766*; Sunnyside, Tahoe Region, 1909, *Eastwood 34*; Cisco, Placer Co., *Rixford*.

A well-marked species which has passed as "*H. velutina* (Piper) Johnston." The type of that latter species, however, came from General Grant Park in Fresno County, and represents the plant with short-tubed subrotate corollas which ranges along the Sierra Nevada of California from

Yosemite Park south to Tulare County. Our present plant occurs in the Sierra Nevada only north of true *H. velutina* and is readily distinguished from that species by its very elongate corolla tube and narrower faucal appendages. An illustration of it, incorrectly identified, is given by Jepson, Fl. Calif. 3: 309, f. 413 (1943).

Hackelia stricta, sp. nov.

Herba biennis 5–10 dm. alta erecta; caulibus saepe solitariis 3–6 mm. crassis fistulosis infra medium pilos sparsos rigidulos minutos recurvos supra medium ascendentis gerentibus; foliis inferioribus oblanceolatis 5–10 cm. (petiolo incluso) longis 12–30 mm. latis apice acutis infra medium in petiolum 1–5 cm. longum gradatim attenuatis; foliis medialibus et superioribus sessilibus 2–5 cm. longis 1–2 cm. latis medium versus latioribus utroque acutis; lamina folii in facie superiori inconspicue sparseque strigosa (pilis e basi pustulata perinconspicua saepe orientibus), in facie inferiori pallidiori pilis rigidulis minutis erectis vel ascendentibus e pustula inconspicua orientibus donata; inflorescentia elongata, ramis strictis fructiferis 5–10 cm. longis; pedicellis 1–2 mm. longis, fructiferis ad 4 mm. longis strigosis; calyce 1.5–2 mm. longo, lobis oblongo-lanceolatis saepe fuscis; corolla 2–2.5 mm. longa, limbo 4–5 mm. diametro, lobis orbicularibus 1.2–1.7 mm. diametro azureis divaricatis, tubo 1.5 mm. longo ad 1 mm. crasso, appendiculis faucium trapaeziformis minutis; nuculis 4 heteromorphis ca. 3 mm. longis, 1–2 stramineis dorse aculeos congestos 3.5–4 mm. longos apice glochidiatos conspicue gerentibus, 2–3 griseis margine encrassatis dorse aculeis ad 0.5 mm. longis vel papillis apice glochidiatis sparse donatis.

MEXICO STATE: Nevada de Toluca, Oct. 1903, *Rose & Painter 7932* (TYPE, Gray Herb.); Las Cruces, Dist. Temascaltepec, fir forest, *Hinton 4901*; Meson Viejo, Dist. Temascaltepec, by river, *Hinton 1303*; Desierta Vieja, Valley of Mexico, *Bourgeau 881*; Sierra de las Cruces, *Pringle 5259* and *9318*; summit of Ajusco, *Harshberger 130*; Cañada de San Rafael, *Lyonnet 340*. MICHOACAN: Tancitaro, near stream, *Leavenworth 731*. GUERRERO: Teotepec, pine forest, *Hinton 14435*. OAXACA: Sierra San Felipe, *Pringle 4832* and *Nelson 1045*. INDEFINITE: *Coulter 1056*.

This is the widely distributed and repeatedly collected *Hackelia* of central Mexico, usually identified as *H. mexicana* (C. & S.) Johnston. That species, however, is actually known only from the mountains between Jalapa and Orizaba and is most closely related to *H. guatemalensis* Brand, of Chiapas and Guatemala. The present plant is distinguished by its erect stiff habit, biennial root, light green herbage, smaller narrower nutlets with more crowded aculeae, and small faucal appendages. The veins on the under surface of its larger leaves are not densely grayish strigose and so not so conspicuous as those in *H. mexicana* and *H. guatemalensis*. In gross habit our plant most resembles *H. floribunda* (Lehm.) Johnston, of western United States. Its close relationships, however, are with the congeners of Central and South America and particularly with *H. leonotis* of the mountains of Nuevo Leon.

Hackelia Skutchii, sp. nov.

Herba perennis 1–5 dm. alta; caulibus erectis 1.5–3 mm. crassis griseis retrorse strigosis; foliis (radicalibus ignotis) supra viridibus plus minusve antrorse strigosis medio-longitudinaliter sulcatis, subtus pallidis dense retrorse strigosis saepe plus minusve sericeis costa prominenti et non rariter

venis salientibus donatis; foliis inferioribus oblanceolatis 6–9 cm. (petiolo incluso) longis apice acutis et non rariter inconspicueque breviterque acuminatis ca. 2 cm. infra apicem 6–10 mm. latis deinde deorsum in petiolum 1–4 cm. longum 1–2 mm. latum gradatim attenuatis; foliis superioribus lanceolatis sessilibus 1–6 cm. longis basi rotundis; inflorescentia sparse ramosa, ramis fructiferis ad 2 dm. longis; pedicellis 2–4 mm. longis strigosis gracilibus, fructiferis 6–10 mm. longis recurvis; calyce strigoso, lobis ovatis 1 mm. longis fructiferis 1.5 mm. longis; corolla conspicua azurea 7–10 mm. diametro, lobis obovatis divaricatis, tubo ca. 2 mm. longo, appendiculis faucium gibbosis subquadratis minute pubescentibus albis vel flavis salientibus; nuculis 4 heteromorphis 2–2.4 mm. longis ca. 1.5 mm. latis, 3–2 brunneis muricatis dorse papillas sparsas 0.5–1 mm. altas apice glochidiatas gerentibus, 1–2 griseis muricatis aculeos coerulescentis 1–1.5 mm. longos compressos apice glochidiatos dorsaliter et marginaliter sparse proferentibus.

GUATEMALA: Sierra Cuchumatanes, Huehuetenango, alpine meadow, 10,500 ft., fl. palest blue, yellow at center, Aug. 24, 1934, *Skutch 1103* (TYPE, Gray Herb.); near Tunimá, Sierra Cuchumatanes, 3300–3500 m., leaves gray green, corolla pale blue with creamy white raised crown around center, *Steyermark 49257*; above San Juan Ixcay along trail to Tojquía, Sierra Cuchumatanes, 2800–3400 m., corolla pale blue with orange center, *Steyermark 50113*.

A very distinct species characterized by its large pale blue subrotate corollas with salient white, orange or yellow faucal appendages, its heteromorphic nutlets, and its relatively small leaves usually silky strigose beneath. The nutlets not only bear barbed papillae or spines but also numerous conic roughenings on back and sides. At times these pointed roughenings are even terminated in a short bristle. The plant is very well marked and has no obviously close relatives. Its general relationships, however, are with the congeners of Central America and southern Mexico.

Hackelia leonotis, sp. nov.

Herba biennis 3–5 dm. alta; caulibus 2–6 mm. crassis pilis gracilibus 1–2 mm. longis plus minusve retrorsicurvatis laxis vestitis; foliis supra strigosis subtus pilis gracilibus non rariter plus minusve retrorsis laxe vestitis, inferioribus oblanceolatis 5–15 cm. (petiolo incluso) longis lamina 10–18 mm. lata utroque acuta basi in petiolum 3–6 mm. longum 1–2 mm. latum attenuata donatis, superioribus anguste lanceolatis sessilibus 3–6 cm. longis 5–10 mm. latis apice acutis basi angulato-rotundis; ramis inflorescentiae sparsis strictis, fructiferis 10–15 cm. longis; pedicellis 2–4 mm. longis dense strigosis fructiferis 4–6 (vel rariter ad 9) mm. longis; calyce strigoso, lobis sub anthesi ovatis vel triangulari-ovatis obtusis 1–1.5 mm. longis, fructiferis ovato-deltaeideis vel late ovatis ad 3 mm. longis; corolla caerulea, limbo 2.5–4 mm. diametro, lobis ovatis divaricatis, tubo ad 1 mm. longo, appendiculis faucium trapaeziformis minutis pallidis; nuculis 4 heteromorphis ca. 3 mm. longis, 2–3 griseis tuberculas vel aculeos perbrevis apice glochidiatos sparse armatis, 1–2 dorse et marginem versus aculeos 1.5–3 mm. longos gracilis apice glochidiatos gerentibus.

NUEVO LEON: Peak of Cerro Potosi, scattered in upper pine wood, *Mueller 2255* (TYPE, Gray Herb.); near peak of Cerro Potosi, abundant in moist meadow in pine forest, 11,900 ft. alt., 1938, *Univ. Illinois Exped. 969*; Cerro Potosi, 1938, *Schneider 969*; ascent of Cerro Potosi, north hogback about 20 mi. NE of Galeana, common in top pine forest, alt. 11,300 ft., *Mueller 1250*; Canyon below Las Canoas, on Cerro Potosi among shrubs in moist arroyo, *Mueller 2228*.

A well-marked species known only from the peak of Cerro Potosi in the Sierra Madre Oriental of northeastern Mexico. Its relationships are with the species of central and southern Mexico and not with those of United States. In fruiting structures it is very similar to *H. Skutchii* of Guatemala, but very different otherwise, and especially in corolla and in foliage-indument. The plant of Cerro Potosi is especially notable for its erect simple or strictly and sparingly branched stems, its very loose somewhat shaggy indument on stems and lower leaf-surfaces, its evidently heteromorphic nutlets, and its very small corollas.

Cryptantha abata, nom. nov.

Krynitzkia depressa Jones, Contr. W. Bot. 13: 5 (1910), not *Cryptantha depressa* Nels. (1902).

Oreocarya depressa (Jones) Macbride, Contr. Gray Herb. 48: 32 (1916).

Cryptantha modesta Payson, Ann. Mo. Bot. Gard. 14: 278 (1927), not Brand (1924).

The name Payson applied to this well-marked species of southern Utah is invalid because of an earlier homonym, a fact overlooked until it was recently called to my attention by Mr. William A. Dayton.

Cryptantha Barnebyi, sp. nov.

Planta perennis 1.5–3 dm. alta pilis flavescentibus vestita; foliis caudicis oblanceolatis 5–8 cm. (petiolo incluso) longis costatis sed enervatis, 1–2 cm. infra apicem acutum vel anguste obtusum 7–14 mm. latis deinde deorsum in petiolum 1.5–2.5 mm. latum plus minusve 3–4 cm. longum gradatim attenuatis, pilis rigidis rectis numerosis 1.5–2 mm. longis valde appressis e basi pustulata orientibus et pilulis inconspicuis mollibus 0.1–0.5 mm. longis dense vestitis; foliis inferioribus caulinis oblanceolatis ad 5 cm. longis 5–8 mm. latis hirsutis (pilis rigidis ascendentibus e basi pustulata orientibus donatis); caulibus horni rigidis erectis costatis ad 5 mm. crassis hirsutis (pilis rigidis pungentibus divaricatis 1.5–3 mm. longis et pilulis abundantioribus plus minusve retrorsis perinconspicuis 0.1–0.5 mm. longis vestitis) e caudice denso ramulos crassos congestos brevis basibus foliorum annotinis crasse vestitos composito erumpentibus; inflorescentia maturitate ad 15 cm. longa, apice densissima ca. 4 cm. crassa deinde deorsum angustiore et cymas gradatim minoris gerenti, infra medium bracteis conspicuis foliaceis linearibus 15–30 mm. longis et 2–4 mm. latis donata; calyce fructifero ad 13 mm. longo 1–2 mm. longe pedicellato, lobis lanceo-subulatis infra medium ad 2 mm. latis extus setis divaricatis 1.5–3.5 mm. longis et pilulis inconspicuis abundantibus 0.5–1 mm. longis gestis; corolla glabra ad 14 mm. longa, tubo cylindrico 7 mm. longo 2–3 mm. crasso, faucibus 3.3–4 mm. longis sursum ampliatis apice ca. 4 mm. diametro, lobis rotundis 2–2.5 mm. longis 2.5–3 mm. latis, appendiculis faucium intrusis bigibbosis 0.7 mm. latis 0.5 mm. altis pilulis perbrevibus obesis obsitis; antheris 1.5 mm. longis, filamentis perbrevibus 1 mm. infra appendiculas faucium affixis; nuculis 4 griseis nitidis utrinque levibus 4 mm. longis 2.5 mm. latis, margine acutissimis, dorse convexis in ambitu ovatis, ventre late obtusis, sulco angusto lineari fere ad apicem nuculae attingenti.

UTAH: 30 miles southeast of Ouray, Uintah Co., white shale knolls 5550 ft. alt., growing with *C. Grahamii* but much less common, June 17, 1947, Ripley & Barneby 8748 (TYPE, Gray Herb.); 5 mi. west of Bitter Creek on Watson-Ouray road, knoll among junipers on light-colored shale, 6300 ft. alt., fl. pale yellow, May 26, 1935, Graham 8987.

A well-marked species and like *C. Grahamii* and *C. Rollinsii* apparently confined to the Green River Shales in the Uintah Basin of northeastern Utah. Among the distinctive features of the present plant are its yellowish indument, coarse dense caudex, large, long-tubed, protruding corollas, and lustrous, completely smooth, sharp-margined nutlets. The flower color appears to be either white or slightly yellow. One of the cited collections, *Graham 8987*, is immature and was previously listed, Jour. Arnold Arb. 20: 391 (1939) as representative of *C. Rollinsii* Johnston. It is now recognized as belonging to the species so beautifully represented by Mr. Barneby's ample flowering and fruiting material from southeast of Ouray. *Cryptantha Rollinsii* is a biennial plant with grayish or only slightly yellowish indument. Its basal leaves are neither so large nor so narrowly petiolate as those in the sterile leaf-clusters borne on the dense stout caudex of *C. Barnebyi*. Its nutlets are also very different. They are proportionately more elongate in outline, rarely surpass 2 mm. in width, and are always more or less roughened with broad low ridges and tuberculations, especially towards the apex and margins. The decidedly smooth nutlets of *C. Barnebyi* are more suggestive of *C. confertiflora* (Greene) Payson. They have, however, a more prolonged ventral groove and are merely sharp- and not wing-margined. The immediate relations of *C. Barnebyi* are with none of the species mentioned. As a matter of fact I can suggest no species with which it reveals close relationship. It is a very distinct species and one I find pleasure in associating with the name of Mr. Rupert C. Barneby. His very many discriminatingly selected and beautifully prepared specimens are evidence of his interest in this group of West American plants.

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A NOTE ON PHILIP MILLER'S BINOMIALS

E. D. MERRILL

MILLER's *Gardeners Dictionary*, which between the years 1731 and 1807 passed through nine editions in England, and was also translated into French and into German, is a work well known to both botanists and to horticulturists. The taxonomists particularly became concerned with it chiefly when the eighth edition appeared in 1768, for in this edition Miller abandoned the cumbersome pre-Linnaean system of indicating the names of plants by Latin descriptive phrases and accepted the simple binomial system. In the preface to edition eight, p. [3], he states:

"In the last edition of this work [edition 7, 1759, and the Dublin issue of it in 1764], the author adopted in great measure the system of Linnaeus . . . but as many of the plants . . . were not to be found in any of Linnaeus's works then published, Tournefort's system was also applied to take such as were not fully known to Dr. Linnaeus."

While in edition seven he did give numerous references to various Linnaean publications, including even the *Species Plantarum*, he did not then accept the binomial system and continued to utilize the pre-Linnaean descriptive sentences for individual species. Thus the entry "18. *Physalis (Peruviana)*" of edition eight appears in edition seven as "18. *Physalis caule erecto ramoso, ramis angulatis, foliis sinuatis, calycibus acutangulis*." This is merely a simple illustrative case among about 5000 entries. Miller's work is not a simple one to cite for the reason that the 1348 folio pages of edition eight are not numbered, so that generally entries to his new binomials are indicated as *Guilandina glabra* Mill. Gard. Dict. ed. 8, no. 3. 1768; the genera which he recognized are alphabetically arranged.

Thus accurate citation becomes somewhat complicated if one should wish to indicate the exact place of publication of an unlisted binomial such as *Adenanthera pavonica* Mill. In the *Adenanthera* entry in volume one, p. [26], a single species is recognized, and it is there characterized merely as *Adenanthera foliis decompositis*. The very last page of volume two is devoted to a long list of corrections including some additions of binomials where, in the text, apparently by oversight, the pre-Linnaean descriptive phrases had been used. *Adenanthera pavonica* Mill. is actually listed on page [1348] of the entire work as some librarian has worked out the pagination for the Arnold Arboretum copy of this edition.

In an addendum to my paper on the validity of Bartram's¹ binomials I called attention to the fact that if the new names appearing in Bartram's *Travels* (1791) be eliminated, as Dr. Rickett² claimed they should be,

¹ Merrill, E. D. On the Validity of William Bartram's Binomials. *Bartonia* 23: 35. 1945.

² Rickett, W. H. Legitimacy of Names in Bartram's 'Travels.' *Rhodora* 46: 289-391. 1944.

then it could be legitimately argued that all of the new names published by Miller in the eighth edition of his *Gardeners Dictionary* (1768) could also be ignored. This would be catastrophic, because Miller used approximately 5000 binomials, and some hundreds of them were proposed by him as new. Dr. Rickett's argument was that as Bartram did not consistently use the binomial system, accordingly his work should be eliminated under the provisions of Article 68 of the International Rules. My study showed that Bartram *intended* to follow the binomial system, for he used about 360 different binomials, his own new ones and those proposed by earlier botanists, notably Linnaeus and Walter; in only two cases did he use the pre-Linnaean descriptive sentences in lieu of binomials, and in these two cases it was apparently by oversight that he did not indicate specific names in the form of binomials.

An examination of Miller's work, which has been universally accepted by all botanists as a source of new binomials, shows that he too, like Bartram, was inconsistent, and that the percentage of cases where he used only descriptive sentences is probably higher than it is in the Bartram case. Yet it is highly improbable that any botanist would argue for the elimination of Miller's work merely because he was somewhat inconsistent; and, this in spite of the fact that a critical study of his early proposed species, the actual types of most of which are extant in the Sloane herbarium at the British Museum, will result in a considerable number of nomenclatural upsets.

I noted that in the entries under the letter A alone there are about eighteen cases where Miller used descriptive sentences with no indication of a binomial, many of these in genera where he otherwise used binomials. These are: *Adenantha foliis decompositis*; *Alchemilla foliis lobatis sericeis* . . . ; *Aloe foliis erectis subulatis* . . . ; *Althaea foliis simplicibus acuminatis* . . . ; *Amomum scapo nudo spica ovata*; *Amomum scapo nudo spica oblonga obtusa*; *Amomum scapo bracteis alternis laxis* . . . ; *Anguria foliis multipartitis*; *Aparine semine laevi*; *Aparine semine coriandri saccharati*; *Aparine pumila supina, flore caeruleo*; *Arbutus caulibus procumbentibus, foliis integerrimis*; *Arctotis foliis pinnato-laciniatis* . . . ; *Asparagus caule herbaceo erecto* . . . ; *Atraphaxis ramis spinosis*; *Atriplex caule erecto herbaceo* . . . ; *Atriplex caule fruticoso foliis deltoideis* . . . ; and *Atriplex caule fruticoso foliis obovatis*. There are scattered additional entries of this nature up to and including some under the letter M; there are few or none in the remainder of the work.

Miller himself noted his lack of consistency, for the last page of the second volume of the *Dictionary* is devoted to corrections, and here there are about 220 binomials, including many of those which he should have entered instead of the descriptive sentences when he described certain species. These entries appear as: "Adenantha, add (*Pavonica*)," "Alchemilla 2. add (*Hybrida*)," "Aloe, 10. Add (*Humilis*)," "Asparagus 1. add (*Sativa*)," "Atriplex 1. (add *Hortensis*)," etc.

One suspects that it was his intention to provide specific names to replace all of the descriptive sentences which he used in the text, but he overlooked a certain number of these. Thus for the three species of *Aparine* no binomials are suggested, for the *Althaea*, and the *Arctotis*, a single species in each genus, and for the *Arbutus* no binomials are suggested, while in *Gramen*, which he used as a generic name, he described seven species with descriptive sentences, yet in his corrections he added specific names for only three of these. The last polynomial that I have noted is *Mammea staminibus flore brevioribus*. From this one suspects that Miller realized that he was inconsistent in the first volume of his work, but that he gave more critical attention to binomials in the second volume. Clearly it was his intention to use the binomial system consistently, even if he failed to do so in some cases.

A great many of the new Miller binomials were checked on Index Kewensis, and the coverage is excellent. In fact, whoever checked this work actually detected and listed most of the new names which appear not only in the text proper but on the last page of volume two, where Miller manifestly attempted to unify his use of technical names. This is unusually good indexing, for in no case, either in the text or on this last page, is there any indication that this or that binomial is actually a new one.

The only reason that I have prepared this short note is because I had previously called attention to Miller's violation of Article 68 of the International Rules which provides, *inter alia*, that specific epithets are illegitimate: "When they were published in works in which the binary nomenclature for species was not consistently employed." In my personal opinion this should not be applied to either Bartram's *Travels* or to the eighth edition of Miller's *Gardeners Dictionary*. Manifestly both authors intended to follow the binary system, even if they did in a relatively very few cases fail to do so.

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AMBORELLA TRICHOPODA BAILL.,
A NEW MORPHOLOGICAL TYPE OF
VESSELLESS DICOTYLEDON

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With five plates

INTRODUCTION

THE GENUS *Amborella* is represented by a single species, *A. trichopoda* Baill., which is endemic to New Caledonia. This remarkable plant was provisionally named and briefly described in a footnote by Baillon (5) in 1869, and was more extensively discussed by him (6) in 1873. Baillon's descriptions were based upon material collected by Vieillard (nos. 32 and 2296) and Balansa (no. 1800) in moist forests in the environs of Balade. The plant is stated to be a shrub of slightly scandent habit which attains a height of from six to eight meters. The best illustrations of its leaf, its male inflorescence, its male flowers, and its fruit are those of Perkins (13); the female flowers are unknown. The only anatomical investigations of the plant are those of Perkins (12), who closely followed Hobein's (8) procedure in the study of monimiaceous genera and focused her attention primarily upon the structure of the leaf and upon the width of the rays in the secondary tissues of the stem. In so doing, she appears to have overlooked the extremely significant fact that the xylem of *Amborella* is vesselless and resembles that which occurs in young stems of *Drimys* and of other representatives of the Winteraceae.

Baillon stressed the close similarity of the male flower to that of *Hedycarya* and included *Amborella* in the Monimiaceae. Subsequently, Ben-
tham and Hooker (7) placed the genus in the tribe Monimieae of the Monimiaceae, whereas Pax (11), and Perkins and Gilg (14) included it in the tribe Hortonieae of the sub-family Monimioideae of this family.

The fact that a new type of living vesselless dicotyledon should come to light at this late date has many important morphological implications; the eight previously known genera of vesselless dicotyledons were all well known prior to 1900, van Tieghem (16). It seemed advisable, accordingly, to make as comprehensive a morphological study of *Amborella* as possible, the results of which are summarized on succeeding pages.

MATERIAL EXAMINED

The absence of vessels in the xylem of *Amborella trichopoda* Baill. was first detected in a specimen collected by Vieillard (no. 3149), on loan to the Arnold Arboretum from the Gray Herbarium. This observation sub-

sequently was verified by examination of the stems of a series of other specimens. A complete list of the material studied is as follows:

Gray Herbarium

Vieillard 3149, specimen with female flowers and fruits.

Balansa 1800, specimen in fruit.

Arnold Arboretum

Vieillard 3149, specimen with immature male flowers.

Museum of Natural History, Paris

(Specimens loaned through the courtesy of Professor H. Humbert, Director).

Vieillard 3149, specimen in fruit.

Vieillard 32, specimen with male flower buds.

Balansa 1800, specimen in fruit.

Pancher, Sept. 1870, specimen in fruit.

Licard, 1879, specimen in fruit.

Herbarium of Royal Botanic Gardens, Kew

Vieillard 3149, two male flowers at anthesis, sent through the kindness of Sir Edward Salisbury, Director.

The *Vieillard 3149* sheet of the Gray Herbarium bears numerous fruits, and, in addition, a few female flowers which unfortunately have been fed upon at some time by insects. However, we have succeeded in reconstructing the form of the previously unknown female flower by a careful study of these fragments.

THE STEM

The largest stem of *Amborella* (*Vieillard 3149*, G.H.) of which we have succeeded in obtaining material is seven millimeters in diameter. A transverse section of a smaller stem, 3.5 millimeters in diameter, is illustrated in *Fig. 30*. The phloem and the collenchymatous outer cortex are considerably compressed owing to contraction in drying. *Figs. 30, 31*, and *37*, but the pith, the primary and the secondary xylem, and the zone of cortical sclerenchyma are well preserved. The pith is relatively homogeneous, being composed of moderately thick-walled, conspicuously pitted parenchyma, and being devoid of idioblasts, nests of stone cells, or sclerenchymatous diaphragms. Vertically elongated strands of parenchyma are confined to the perimedullary region in close proximity to the elements of the primary xylem.

Most of the rays of the secondary xylem are uniseriate or biseriate, as emphasized by Perkins (12). However, broader rays, three to five cells in width, are of not infrequent occurrence, and extend outward from conspicuous interfascicular parts of the eustele, *Fig. 37*. The narrower rays are vertically extensive and are composed of much elongated "erect" cells, *Fig. 38*. The cells of the multiseriate rays tend to become nearly as extensive radially as vertically. Wood parenchyma strands are few in number and are diffusely distributed.

The tracheids of the vesselless xylem occur in relatively uniform radial series, *Fig. 37*. They are long imperforate tracheary cells, *Fig. 38*, and, in the case of the secondary xylem, obviously are formed, as in *Tetra-*

centron, *Trochodendron*, and the Winteraceae, by a primitive type of cambium having long fusiform initials with extensively overlapping ends. The inter-tracheary pitting, which is dominantly scalariform in the last-formed tracheids of the metaxylem, fluctuates between scalariform and circular in the secondary xylem, *Fig. 39*. The conspicuously bordered pits are numerous and tend to be more or less closely crowded in the radial walls of the tracheids, whereas they are smaller and of sporadic occurrence in the tangential walls. The pits between tracheids and parenchymatous cells are small, circular, and bordered.

There are no fibers in the phloem or the cortex of the stem. The sclerenchymatous ring visible in *Fig. 30* is composed solely of "hippocrepiform" sclereids, *Fig. 31*. The parenchymatous cells of the phloem and the outer cortex contain much darkly colored, colloidal, vacuolar material of presumably phenolic composition, *Fig. 31*.

THE LEAF

The alternately disposed leaves of *Amborella* fluctuate considerably in size, form, and degree of pilosity even on sheets having the same collection number. Some are oblong with slightly wavy margins, as figured by Perkins (13), whereas others are ovate with conspicuous lobes, *Figs. 1* and *3*, or are elliptic-lanceolate with entire or serrate margins, *Fig. 2*. Certain of the leaves, viz. *Vieillard 32* (Paris), *Balansa 1800* (Paris), *Licard*, 1879 (Paris), have numerous hairs on both surfaces, whereas others, i.e. *Vieillard 3149* (G.H.), are glabrous. Whether such differences are due solely to differences in age of the leaves, as has been assumed, appears to us to be somewhat questionable.

The leaf is characterized by having a single broad, arc-shaped strand of vascular tissues in its petiole, *Fig. 32*, and in the costa of the lamina, *Fig. 33*. This leaf trace is attached to the eustele of the stem at a typical unilacunar node, *Fig. 30*. Thus, *Amborella* differs from *Tetracentron* and the Winteraceae, which have prevailingly trilacunar nodes, and from *Trochodendron*, which tends to form multilacunar ones.

The cortical parenchyma of the petiole is collenchymatous, collapses in drying, and does not fully re-expand even when treated with sodium hydroxide, *Fig. 32*. Hippocrepiform sclereids either are absent or develop less precociously in the petiole and the basal part of the costa, compare *Figs. 30, 32*, and *33*. On the contrary, the upper part of the mid-vein, the lateral veins, and the terminal veinlets are completely jacketed by hippocrepiform sclereids. According to Perkins (12), there are no palisade or hypodermal tissues in the lamina of the leaf. However, when leaves are cleared and re-expanded by treatment with sodium hydroxide, there appears to be a well defined hypodermal layer subtending the upper epidermis. The cells of the spongy mesophyll, *Fig. 33*, as in the case of the phloem and the outer cortex of the stem, contain a high ratio of darkly colored vacuolar material, i.e. "Gerbstoffe," Perkins (12).

The stomata are confined to the lower surface of the leaf. They fluctu-

ate considerably in form and the extent to which the guard cells are subtended by parts of adjacent epidermal cells. The stomata may have subsidiary cells that are oriented parallel to the guard cells, *Fig. 6*, or they may be surrounded by a number of ordinary epidermal cells, *Fig. 5*. The stomata are provided with a conspicuous outer cuticular vestibule as illustrated in *Fig. 7*.

The foliar hairs are straight and comparatively short, but are of a thin-walled multicellular type, *Fig. 4*. These trichomes are jacketed by a thick cuticle which is continuous with that of the outer surface of the leaf. The hair may have a single submerged basal cell or it may be attached to a more or less protuberant, multicellular pedestal.

THE MALE FLOWER

The male flowers of *Amborella* have been described by a succession of authors, viz. Baillon (6), Bentham and Hooker (7), Pax (11), Perkins and Gilg (14), and have been figured by Perkins (13). Although the consensus of opinion appears to be that the stamens are numerous ("ultra 20"), Perkins and Gilg (14) in their key to the genera of the Monimiaceae differentiate *Amborella* from *Peumus* upon the basis of "Stamina 9 eglandulosa, Fl. ♀ sine staminodiis," whereas in their description of *Amborella* they state, in agreement with other writers, "Stamina ∞ (ultra 20) ... Fl. ♀ ignoti." Subsequently Perkins (13) figured a male flower from *Vieillard 3149* (Kew) with 19 stamens. In material examined by us, *Vieillard 3149* (Kew) and *Vieillard 32* (Paris), the number of stamens varied from 10 to 12.

The stamens are stated to have "filamentis brevissimis" and are figured by Perkins (13) with narrow, short, cylindrical "filaments." In the material of *Vieillard 3149* (Kew), the stamens at anthesis, *Figs. 8* and *9*, as in so many other ranalian plants, are broad, flat appendages bearing sporangia. The outer stamens tend to be larger and exhibit a more conspicuous branching of the vascular strand, compare *Figs. 8* and *9*. The basal parts of the stamens bear more or less numerous, faintly striated hairs. These hairs commonly are unicellular, but may at times be composed of two cells. The epidermal cells at the apex of the outer stamens tend to differentiate into numerous papillae.

The male flower appears to have incipient perigynous tendencies, i.e. concavity of the torus and conrescence and adnation of parts. However, the vascularization of the flower is still relatively simple. The pedicel contains a ring of discrete vascular bundles and each bracteole is vascularized by a single strand. The vascular bundles increase in number toward the base of the torus and each tepal is vascularized by a single strand. The inner stamens exhibit no evidence of adnation to the base of the tepals and each is vascularized by a single trace from the apex of the torus. On the contrary, the larger outer stamens are vascularized by branches from the trace of the tepal which subtends them.

The pollen grains of *Amborella* resemble those of various monimiaceous genera in having a tenuous, finely papillate exine. They fluctuate considerably in form. Those obtained from open flowers of *Vieillard 3149* (Kew) have an irregular unthickened area on one polar face, *Figs. 18* and *19*, whereas pollen from flower buds of *Vieillard 32* (Paris) are uniformly thickened and granular appearing on all surfaces. The former pollen grains are circular in polar view, *Figs. 18* and *19*, having a diameter which averages approximately 27 micra. When viewed at right angles to the presumed polar axis, the pollen grains exhibit the form illustrated in *Fig. 20*, i.e. broader and flatter on the face opposite the germinal area. This shape of the pollen suggests that the grains may possibly be formed in tetragonal tetrads, and the irregular unthickened area may be on the proximal side of the grain as in certain of the Annonaceae, Bailey and Nast (1).

THE FEMALE FLOWER

The gross external morphology of the female flower, reconstructed from fragments of open flowers of *Vieillard 3149* (G.H.), may be summarized as follows:

Pedicle naked or bearing from one to four bracteoles. Tepals six to eight, slightly connate at the base, in two series, those of the inner more nearly cyclic series broader with expanded membranous margins. Staminate one, or occasionally two, resembling the stamens of the male flower in form, but sterile and basally adnate to a subtending tepal. Carpels five, free, obovoid, borne on the slightly convex center of the torus; stigma oblique, sessile, extensive, with two conspicuous feathery flanges.

In general, the pedicle and the perianth of the female flowers, *Figs. 12* and *13*, resemble those of the male flowers. Although there is no sharply defined differentiation into calyx and corolla, the five upper tepals commonly are larger, broader, and have a more nearly cyclic orientation. The staminate, *Figs. 10, 13*, and *14*, is broad and basally adnate to a subtending tepal, *Fig. 14*. It commonly bears a more or less rudimentary anther, with sporangial cavities and more or less extensive endothelial thickening, but is devoid of pollen in the limited number of specimens that we have examined.

The carpel of *Amborella* appears to exhibit a particular trend of specialization of the primitively conduplicate ranalian carpel, compare Bailey and Nast (2). The basal part of the carpel is sealed, whereas the extensively developed paired stigmatic crests of the upper part of the conduplicate carpel are unfolded, *Figs. 15* and *16*. Each carpel contains a single anatropous ovule which is directly attached to the ventral side of the locule by a short, obliquely oriented raphe. The level of attachment to the carpellary wall fluctuates between one-half and two-thirds of the distance between the base and the apex of the locule. The micropylar end of the ovule points downward at an angle of considerably less than 90 degrees to the axis of the raphe. The ovule is krassinucellate and bitegumentary,

Fig. 11. The inner integument consists uniformly of three layers of cells, whereas the outer one is composed of five to seven layers on the rapheal side.

The primary vascular system of the pedicel of the female flower is typically eustelic, consisting of a ring of discrete bundles, *Fig. 22*, as in the pedicel of the male flower. Each scale-like bracteole is vascularized by a single strand, *Figs. 22* and *23*. Just below the level of the perianth, the bundles of the eustele become more diffusely arranged owing to incipient broadening of the torus. The traces of the tepals are clearly differentiated at the level illustrated in *Fig. 24*. Each tepal has a single trace in its connate base, which subsequently divides into a median and two lateral veins in its lamina. At the levels illustrated in *Figs. 25* and *26*, there are two concentric circles of vascular strands, an outer one concerned with the tepals and staminode and an inner one of five bundles concerned with the vascularization of the five carpels. At the base of each carpel, its vascular bundle bifurcates into a large dorsal strand and a smaller ventral one, *Fig. 27*. The dorsal strand develops extensive branches and terminates in an inverted spray of vascular elements, *Figs. 15* and *16*. The ventral strand bifurcates in its upward course and the vascular supply of the ovule is derived from one of its branches. The concrescence of tepals is clearly indicated in *Figs. 26* and *27*. The adnation of the staminode to its subtending tepal is still evident at the levels illustrated in *Figs. 28* and *29*.

THE FRUIT

The drupaceous fruit is obovoid with slightly compressed sides and apex. Vestiges of the stigmatic crests occupy a subterminal position, *Fig. 17*, due to asymmetrical development of the carpel after fertilization. In the case of dried specimens, the external surface of the fruit appears to be reticulately wrinkled with evenly distributed depressed areas, as illustrated by Perkins (13). However, when the fruit is re-expanded, these depressions disappear and the entire surface of the fruit becomes smooth. The stony endocarp is not a sclerenchymatous tissue of uniform thickness as figured by Perkins (13), but has highly embossed ridges on its outer surface, corresponding with a complex, reticulate system of vascularization of the exocarp. The softer parts of the exocarp, between the embossed ridges of the thick sclerenchymatous layer, appear at times to give rise to cup-shaped lysigenous lacunae, *Fig. 34*. The unaffected outer layer of the exocarp presents a more or less uniform cellular organization, though the general uniformity may be defaced here and there by the eruption of corky excrescences.

A single seed occupies the entire cavity of the fruit, *Fig. 34*. Baillon (6) and Willis (17) state that the seed is pendulous and orthotropous, but the orthotropy has been questioned by Pax (11). As we have demonstrated on preceding pages, the ovule is anatropous, *Fig. 11*. During post-fertilization development, the enlargement of the carpel and seed is such that the lateral attachment of the seed appears to occur at a higher

level in the locule. At the same time, the originally oblique raphe becomes deflected, as indicated by its vascular strand, into an orientation more nearly at right angles to the long axis of the seed, *Fig. 17*. In fruits from herbarium specimens, the crushed remains of the two integuments have assumed a membranous texture and constitute the seed coat, *Fig. 35*. The cells of the outermost layer of the outer integument are conspicuous owing to their content of darkly colored, phenolic, vacuolar material.

The bulk of the seed, *Fig. 35*, is composed of a compact endosperm whose constituent cells are of relatively uniform size and shape, those at the periphery, however, being smaller and having more darkly stained contents, *Fig. 36*. The embryo is minute, *Figs. 35 and 36*, and is situated at the lower apex of the downwardly projecting seed. In fruits from various collections examined by us, the embryo exhibits merely incipient stages of the formation of cotyledonary primordia.

SECRETORY IDIOBLASTS AND CRYSTALS

According to Perkins (12), there are no secretory cells containing ethereal oils or resins in the pith or cortex of the stem, but she states that a few small cells of this type occur in the spongy mesophyll of the leaf. Although we have utilized a variety of special techniques, we have not succeeded in demonstrating the presence of such cells in any tissues of the stem, leaf or floral appendages. Nor have we succeeded in demonstrating the presence of mucilaginous cells, such as occur in the Lauraceae and are considered to differentiate this family from the related Monimiaceae.

The tissues of *Amborella* do not contain druses or large rhombic crystals of calcium oxalate. Nor have we been able to find small acicular crystals which are stated by Solereder (15) to occur so commonly in the Monimiaceae, Lauraceae, and Hernandiaceae. However, entire absence of crystals and of secretory idioblasts cannot be conclusively established until properly preserved material of freshly collected specimens is obtainable.

DISCUSSION

Since the publication of Baillon's (6) description, *Amborella* has consistently been placed in the Monimiaceae, and by Pax (11) and Perkins and Gilg (14) in the Hortoniaceae, the florally most primitive tribe of the family. The vesselless xylem of *Amborella* raises the question whether the genus actually belongs in the Monimiaceae, and what its relationships to other vesselless genera of the dicotyledons may be.

Relatively few botanists are inclined to follow van Tieghem (16) in segregating vesselless dicotyledons in a special order, the Homoxylées. Indeed, there are grave dangers in basing phylogenetic conclusions and classification upon the study of any *single* organ, tissue, or morphological character. Much of the confusion in past and present botanical literature is due to a failure to recognize that parallel and convergent evolution are of common occurrence in all organs of the vascular plants, and to allow for the fact that morphological specializations rarely, if ever, occur simultane-

ously and at uniform rates in all parts of a plant. Deductions regarding relationships should be based, therefore, upon careful assessment of evidence from all organs, tissues, and parts of the plant.

The totality of morphological evidence indicates that the Winteraceae (*Drimys*, *Pseudowintera*, *Bubbia*, *Belliolum*, *Exospermum*, and *Zygogynum*) are at best only remotely related to the Magnoliaceae and other surviving ranalian families, Bailey and Nast (3). Similarly, it demonstrates that, although *Tetracentron* and *Trochodendron* should be placed in close proximity, they bear no close relationship to the Winteraceae or even to such genera as *Euptelea* and *Cercidiphyllum*, Bailey and Nast (4), Nast and Bailey (9 and 10).

The general structural similarity between the vesselless xylem of *Amborella* and that of comparable young stems of the Winteraceae, *taken by itself*, provides no cogent evidence for including the genus in that family. Fundamental structural differences in the flowers, in the pollen, in the pith and cortex, and in the vascularization of the leaf, etc., provide a negation of such a possibility. In even greater measure, the totality of evidence excludes any possibility of including *Amborella* either in the Tetracentraceae or the Trochodendraceae. This leaves unanswered the question whether *Amborella* should likewise be excluded from the Monimiaceae.

Possible evidences of relationship to the Monimiaceae are (1) incipient perigynous tendencies particularly in the male flower, coupled with unisexuality, (2) form and structure of the pollen, (3) uniovulate carpels, (4) presence of hippocrepiform sclereids, (5) unilacunar nodal anatomy, (6) absence of druses and large rhombic crystals of calcium oxalate, and (7) absence of a combination of special morphological characters indicative of close relationship to any other family. Potentially significant differences are (1) absence of vessels and of septate fibers in the xylem, (2) absence of fibrous sclerenchyma in the pith and cortex of the stem, and in the leaf and other appendages, (3) apparent absence of conspicuous secretory idioblasts containing ethereal oils or resinous contents, and (4) the presence of multicellular hairs; according to Solereder (15) the Monimiaceae are characterized by having unicellular trichomes or variously clustered groups of such hairs.

Whether *Amborella* should be retained within the Monimiaceae or should be segregated in a new related family must await the results of extensive coöperative investigations that we have undertaken of the various genera of the Monimiaceae. Sufficient progress has already been made, however, to demonstrate that if the present narrow concept of the family is to be retained, other genera in addition to *Amborella* should be excluded from the Monimiaceae (*sensu stricto*). For example, *Trimenia* and *Piptocalyx* have a fundamentally different type of nodal anatomy, have no hippocrepiform sclereids in the cortex of young stems, and have large mucilaginous cells which have been used as a reliable criterion for differentiating the Monimiaceae (absent) from the Lauraceae (present). On the contrary, if the existing concept of the Monimiaceae is to be broadened to in-

clude such genera as *Amborella*, *Trimenia*, and *Piptocalyx*, it should likewise include such genera as *Gomortega* and *Austrobaileya*.

It should be noted in conclusion that the nine surviving genera of vesselless dicotyledons exhibit a wide range of diversified specializations in their floral organs, indicative, as prophesied by van Tieghem (16), that additional morphological types will ultimately be discovered either in living or fossil floras. Of the nine known genera, five (*Bubbia*, *Belliolum*, *Exospermum*, *Zygogynum*, and *Amborella*) occur in New Caledonia, and three (*Amborella*, *Exospermum*, and *Zygogynum*) are endemic on that Island.

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EXPLANATION OF PLATES

All plates show *Amborella trichopoda* Baill.

PLATE I

Figs. 1-3. *Balansa 1800* (Paris). Variation in the form of the leaves. $\times \frac{1}{2}$. Fig. 4. *The same*. Multicellular hair. $\times 280$. Fig. 5. *Vieillard 3149* (G.H.). Surface view of a stoma showing subsidiary epidermal cells. $\times 600$. Fig. 6. *The same*. Stoma with subsidiary cells oriented parallel to the guard cells. $\times 600$. Fig. 7. *The same*. Transverse section of a stoma, showing the cuticular vestibule. $\times 600$. Figs. 8 and 9. *Vieillard 3149* (Kew). An outer and an inner stamen viewed from their adaxial side. $\times 21$. Fig. 10. *Vieillard 3149* (G.H.). Staminode of a female flower, showing sterile anther. $\times 21$. Fig. 11. *The same*. Longitudinal section of a carpel, showing pattern of vascularization and the anatropous ovule. $\times 25$.

PLATE II

Fig. 12. *Vieillard 3149* (G.H.). Reconstruction of a female flower, with one inner tepal removed to show the five carpels. Staminode at the right. $\times 10$. Fig. 13. *The same*. Flower oriented to show the breadth of the staminode. $\times 10$. Fig. 14. *The same*. Part of a female flower, showing one carpel and the adnation of the basal part of the staminode to its subtending tepal. $\times 10$. Fig. 15. *The same*. Lateral view of a cleared carpel, showing pattern of vascularization. $\times 33$. Fig. 16. *The same*. Cleared carpel, viewed from its dorsal side. $\times 33$. Fig. 17. *The same*. Longitudinally dissected, cleared fruit, showing vascularization and attachment of the seed. $\times 8$. Figs. 18 and 19. *Vieillard 3149* (Kew). Polar views of pollen, showing variation in the size and form of the irregular unthickened areas. $\times 800$. Fig. 20. *The same*. Pollen grain viewed at right angles to the polar axis. $\times 800$.

PLATE III

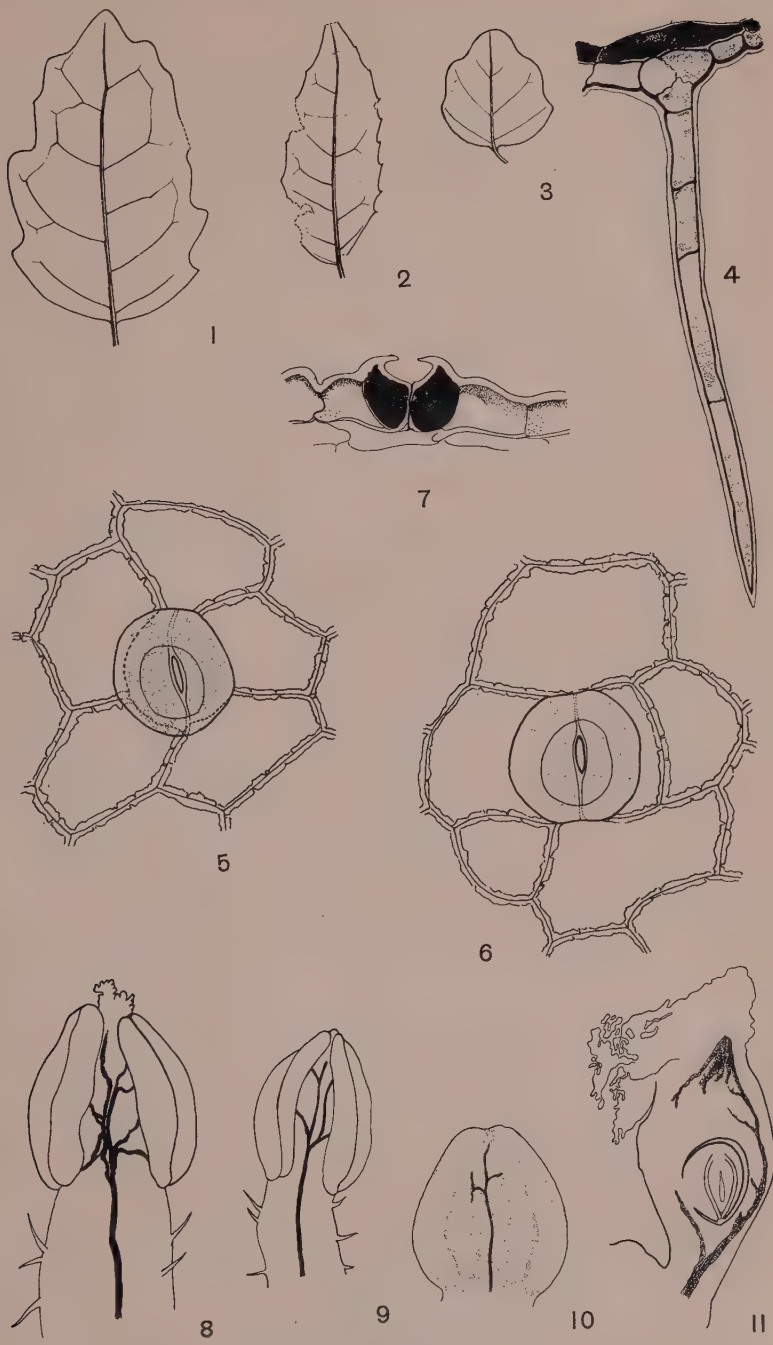
Figs. 22-29. *Vieillard 3149* (G.H.). Diagrammatic transverse sections of a female flower cut at successive levels, as shown in Fig. 21. S, vascular strand of staminode. $\times 33$.

PLATE IV

Fig. 30. *Vieillard 3149* (G.H.). Transverse section of the stem, showing unilacunar node and vesselless xylem. $\times 16$. Fig. 31. *The same*. Hippocrepiform sclereids more highly magnified. $\times 170$. Fig. 32. *Balansa 1800* (Paris). Transverse section of the petiole, showing single arc of vascular tissues. $\times 33$. Fig. 33. *The same*. Transverse section of the midvein of the lamina. $\times 33$. Fig. 34. *Vieillard 3149* (G.H.). Longitudinal section of the fruit, showing outwardly projecting sclerenchymatous ridges, and lacunae in the outer exocarp. $\times 9$. Fig. 35. *Licard* (Paris). Longitudinal section of a seed, showing extensive endosperm and minute embryo. $\times 16$. Fig. 36. *Pancher* (Paris). Micropylar region of a seed, showing contracted embryo. $\times 170$.

PLATE V

Fig. 37. *Vieillard 3149* (G.H.). Transverse section of the stem, showing vesselless xylem, uniseriate, biseriate, and multiseriate rays, and hippocrepiform sclereids of the cortex. $\times 73$. Fig. 38. *The same*. Tangential longitudinal section of the secondary xylem, showing form of the rays. $\times 73$. Fig. 39. *The same*. Radial longitudinal section of the secondary xylem, showing the pitting of the tracheids. $\times 340$.

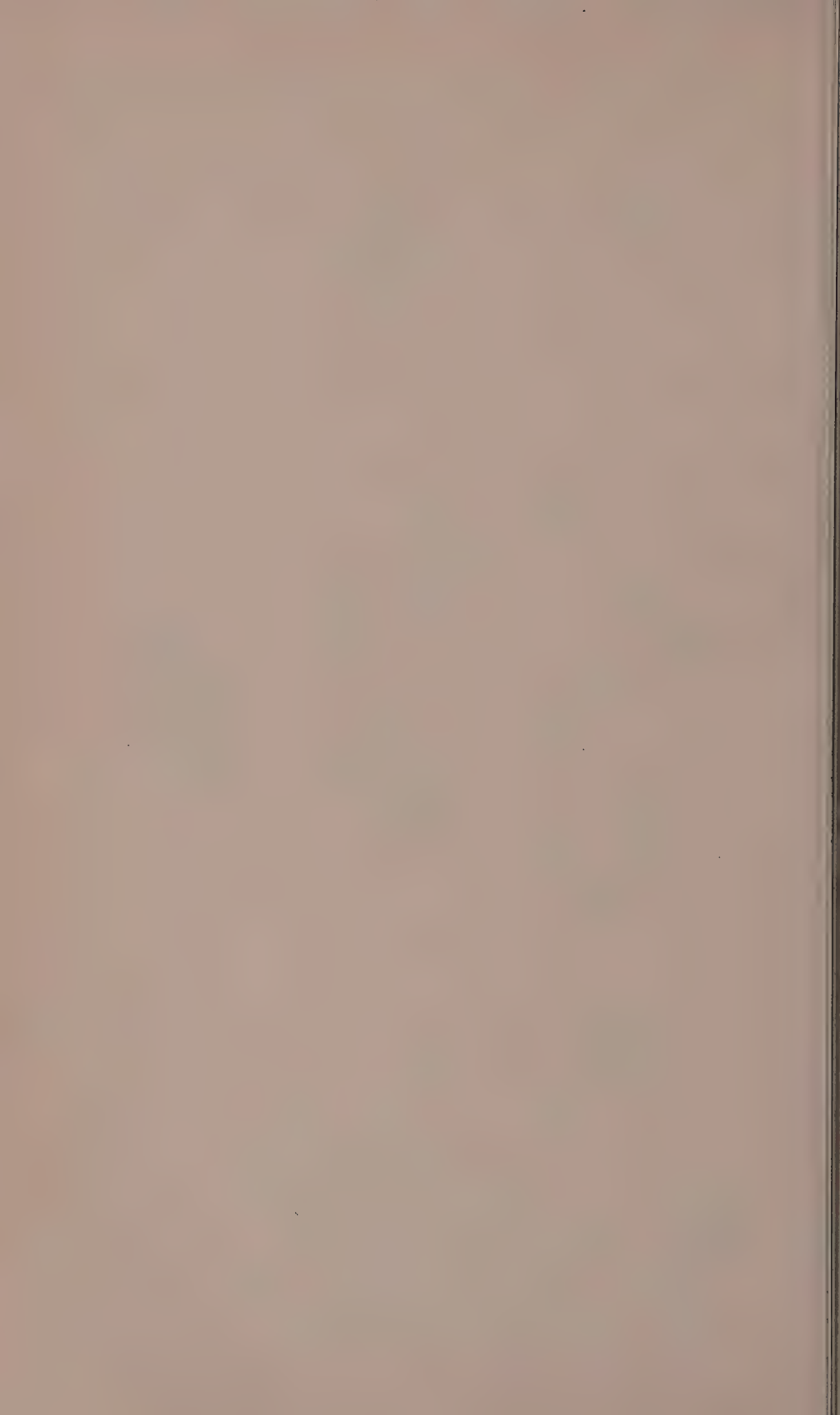


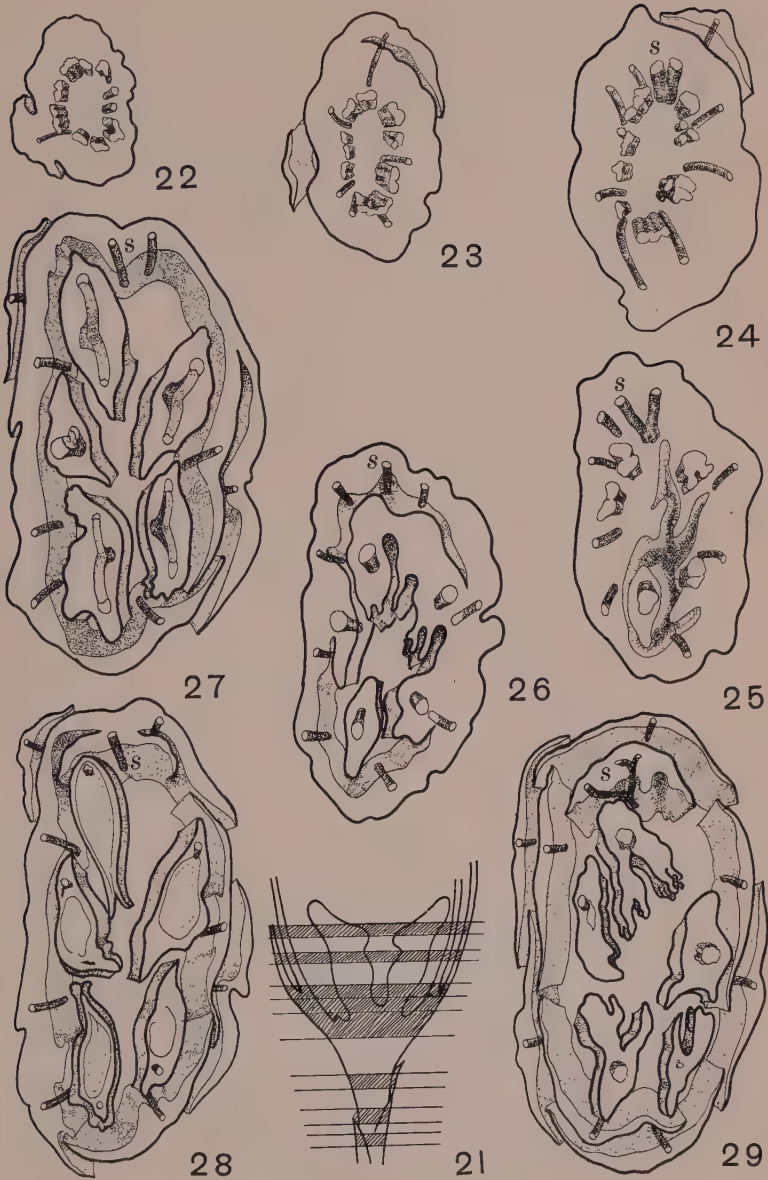
AMBORELLA TRICHOPODA BAILL.





AMBORELLA TRICHOPODA BAILL.

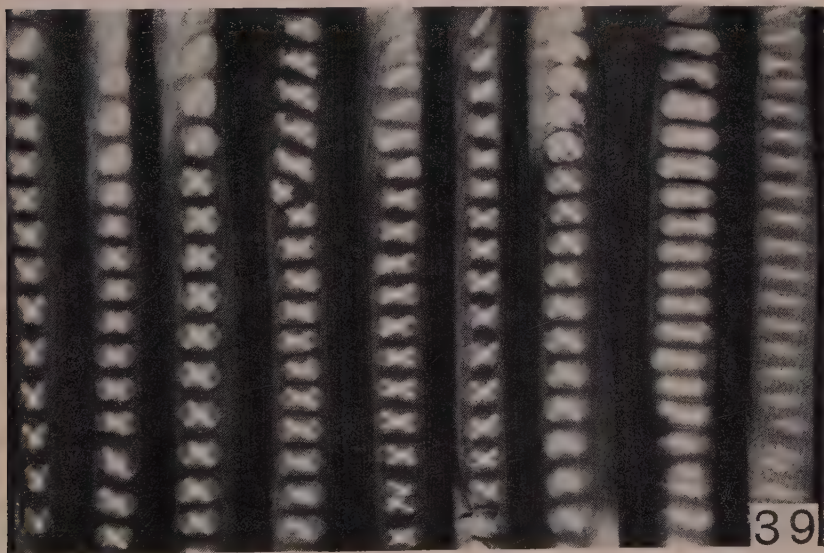
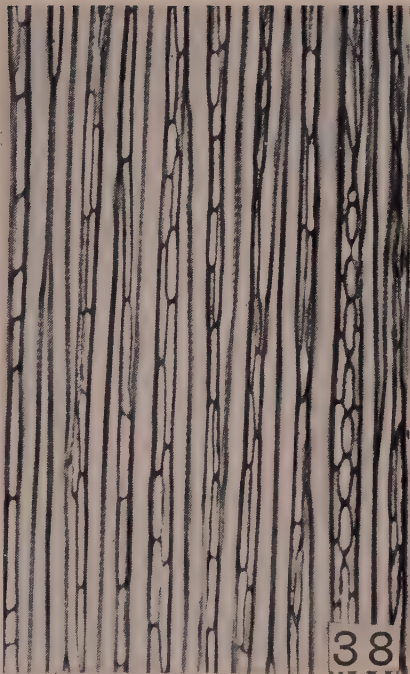




AMBORELLA TRICHOPODA BAILL.



AMBORELLA TRICHOPODA BAILL.



AMBORELLA TRICHOPODA BAILL.

A NEW SPECIES OF AUSTROBAILEYA
(AUSTROBAILEYACEAE) FROM AUSTRALIA

C. T. WHITE

AMONG the many interesting plants collected by Mr. S. F. Kajewski in North Queensland for the Arnold Arboretum in 1929 was *Austrobaileya scandens* C. T. White, described in a general account of the Kajewski collection (Contr. Arn. Arb. 4: 29. *pl. IV*. 1933). As the specimens had been very heavily pressed and rather "over-cooked" in the drying, a satisfactory dissection was difficult and the genus was provisionally placed in the Magnoliaceae. It was later made the type of a subfamily of the Dilleniaceae by Croizat (Jour. Arnold Arb. 21: 404. 1940), who subsequently (Cactus and Succ. Jour. of Cactus & Succ. Soc. America 15: 64. 1943) gave it full family rank.

In 1936, when on a collecting trip (partly financed by the Arnold Arboretum) to Mt. Spurgeon in North Queensland, I collected good flowering material of what I took to be *A. scandens*, and specimens were subsequently distributed from both the Queensland Herbarium and the Arnold Arboretum under this name. Prof. I. W. Bailey, who has recently examined these specimens, wrote me that he considered the Mt. Spurgeon plant a distinct species and sent photographs of stamens and staminodes to bring out some of the differences. On closer examination I have come to the conclusion that Prof. Bailey's contention is correct, and a description is offered herewith.

I have refrained from giving an amended description of the genus until better material of *A. scandens* is available. Several characters perhaps of generic rather than specific value are incorporated in the following description.

Austrobaileya maculata sp. nov.

Frutex glaber, scandens, ramulis teretibus sed ad nodos leviter applanatis. Folia opposita vel subopposita delapsa cicatricem prominentem pulvinatam firmam relinquentia; petioli ca. 2 cm. longi, in sicco cuticula rugulosa obsiti; laminae 12–14 cm. longae, 6.5–8 cm. latae, coriaceae, in sicco utrinque opacae et subtus valde pallidiorae, utrinque prominenter reticulatae, ovato-ellipticae vel fere ovatae; margine recurvae, basi subacutae vel fere obtusae, apice plus vel minus abrupte acuminatae, acumine ipso 1–1.5 cm. longo. Flores axillares, solitarii, pedunculati; pedunculi 0.5–1 cm. longi, basin versus bracteati, bracteis 0.5–1 mm. longis, inferioribus suborbicularibus superioribus ovatis. Perianthii segmenta ca. 21 pallido-viridia ab extimo minimo ad intima petaloidea gradatim sed plus vel minus irregulariter mutata, segmenta minima latissime ovata 2 mm. longa, maxima oblonga 2 cm. longa, 1 cm. lata. Stamina 9, filamentis petaloideis pallido-viridibus maculis purpureis elevatis papillosis dense

notatis, 1 cm. longis, 0.4 cm. latis, antheris 3 mm. longis, introrsis 2-locularibus, loculis parallelibus longitudinaliter dehiscentibus filamenti ad faciem interiorem per totam longitudinem eorum affixis. Stamina 16 staminis angustiora utrinque maculis purpureis densissime notata. Discus 3 mm. altus firme carnosus. Carpella 9, superiora, libera, cum stylo 7 mm. longa, stylo ipso 4 mm. longo ad apicem bifido, ovulis ca. 9 in placentis 2 parietalibus biserialiter dispositis.

QUEENSLAND: Cook District: Mt. Spurgeon, alt. ca. 4000 ft., rain-forest, C. T. White 10734 (fls.) Sept. 1936 (large climber, perianth-segments pale green, outermost ones small, gradually larger towards the centre of the flower; stamens pale green, those of the outermost series the largest, marked with purple spots, few on the outer face, more on the inner; stamens of the inner series (staminodia) densely purple-spotted both inside and out; carpels yellow). TYPE in Herb. Brisbane.

Distributed from Herb. Brisbane and Arnold Arboretum as *A. scandens* C. T. White.

Very distinct from the only previously known species of the genus, *A. scandens* C. T. White; the two species can be easily distinguished as follows:

Leaves (in dried specimens) nitid, elliptic to lanceolate; stamens and staminodes pale green, blunt at the top.....	<i>A. scandens</i> .
Leaves (in dried specimens) dull, elliptic-ovate to ovate; stamens and staminodes pale green, very densely marked with raised papillose spots; stamens pointed at the top	<i>A. maculata</i> .

BOTANIC MUSEUM AND HERBARIUM,
BRISBANE, QUEENSLAND,
AUSTRALIA.

THE GRAMINEAE-PANICOIDEAE OF NEW GUINEA *

JOHN R. REEDER

With seven plates

INTRODUCTION

NO COMPREHENSIVE treatment of the Gramineae of New Guinea has yet been published. Several papers dealing with the known species of this island and adjacent regions have appeared, the more extensive being those by Hackel (24),¹ Schumann and Lauterbach (69, 70), and Hitchcock (33, 35) and Chase (17, 18). With the exception of the botanical novelties, all of the above are merely lists of the species with citations of the specimens examined, although critical notes are sometimes included.

The works dealing with the grasses of this region are widely scattered in botanical literature, many in publications which are unavailable except to those having access to extensive botanical libraries. The present paper is an attempt to bring this information together in readily available form for easy consultation by anyone interested in New Guinea grasses.

The original plan was to study the entire family in New Guinea, but the task proved too great for the time which was available. The subfamily Panicoideae was studied first, since it appeared to present more taxonomic problems than the Festucoideae. It is the hope of the writer that in the near future he will be able to study this other subfamily and thus make our knowledge of the Gramineae of New Guinea easily accessible.

The present paper represents a systematic study of one subfamily, the Panicoideae.² All of the species are described and keys to the tribes, genera, and species are included. The subfamily Panicoideae, as treated here, consists of the three tribes, Paniceae, Andropogoneae, and Maydeae. This is the delimitation accepted by most modern students of the group,³ although it is a somewhat more limited concept than that of Hackel (21). Actually Pilger includes another tribe, the Arthropogoneae, but none of the four genera which he includes in it occurs in New Guinea. This subfamily contains more than half the grass genera found in New Guinea, many of which are extremely complex taxonomically.

* A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Biology, Harvard University, June 1947.

¹ For citation of bibliography and list of exsiccatae, see end of Part II in the next number of this Journal.

² In addition to New Guinea itself, when available, specimens from the Bismarck Archipelago and Solomon Islands are also cited.

³ See Hubbard (37) and Pilger (59).

The work was carried out chiefly at the United States National Herbarium and is based principally upon the rather extensive New Guinea collections at that institution, at the Gray Herbarium and Arnold Arboretum of Harvard University, and at the Britton Herbarium of the New York Botanical Garden. Because of conditions as a result of the recent war, it has been impossible to secure the loan of material from Buitenzorg, Java, and from certain herbaria in Europe. These collections might have included some additions to the grass flora, but it is believed that the present account is reasonably complete.

In addition to the actual New Guinea collections, the United States National Herbarium has abundant material representing the grass family from all parts of the world. The extensive Philippine and Chinese reference collections have served as an invaluable aid during this study. Largely through the efforts of Mrs. Agnes Chase and the late Dr. A. S. Hitchcock, the Grass Herbarium of this institution is rich in type material. In addition to actual types and type duplicates, there are numerous fragments of types accompanied by notes and often by photographs. Some of these fragments may well represent the only type record of that species now in existence because of losses suffered by foreign herbaria during the war. In connection with the Grass Herbarium, Mrs. Chase and Dr. Hitchcock are also responsible for the assembling, over a period of about fifty years, of an extensive agrostological library which is remarkably complete. This library as well as the collections has greatly facilitated this study.

An attempt has been made to account for every published binomial belonging to this subfamily, as recorded from New Guinea, from the time of the earliest explorations until the present date. Sources of all names are cited and an effort is made to clarify the often complicated synonymy in those cases in which references to binomials are found in literature concerning New Guinea. The grass family is such a large and critical group that the number of names under certain species is often very large. For this reason no attempt is made to account for all the synonyms of a given binomial unless they have been accepted as valid names in works dealing specifically with New Guinea plants. In citing the accepted binomial and its synonyms, in addition to the place of original publication, other references to works in which the same species has been considered more or less critically and references to illustrations are often added. In those cases in which the binomial has been used in literature relating directly to New Guinea, the place of publication of the first such report is also cited.

In adopting generic limitations used by most modern authors, 52 genera are recognized as occurring in New Guinea. Of these, 22 are included in the Tribe Paniceae, 27 in Andropogoneae, and 3 in Maydeae. Many of the genera contain species which have an extremely wide range in the tropics, some are weedy species which occur also in temperate regions and are obviously introductions, while others, mostly those of rather high altitudes, appear to be endemic.

With the exception of a few doubtful ones, a total of 133 species, 3 subspecies, and 17 varieties is recognized in this study. This is more than five times the number of species known to Hackel in 1890 (24), and more than twice the number reported by Schumann and Lauterbach in 1901-1905 (69, 70). Hitchcock (33) and Chase (17, 18) together enumerated 96 species and 7 varieties in 1935-1943, but their reports were based entirely upon the collections of the three Archbold Expeditions. These expeditions were sponsored by Mr. Richard Archbold, his Archbold Expeditions being affiliated with the American Museum of Natural History. The first expedition was based on Port Moresby and explorations extended inward to the summit of the Owen Stanley Range, the second was an extended trip up the Fly River, and the third explored the Mount Wilhelm region of central Netherlands New Guinea. The excellent botanical collections were made by Mr. L. J. Brass, who was assisted, when in Netherlands New Guinea, by Mr. C. Versteegh and Dr. E. Meyer-Drees. The botanical collections assembled on these three extensive expeditions were turned over to Dr. E. D. Merrill for study and for distribution of the duplicate sets. In as far as grasses are concerned, these collections are the most extensive which have thus far come out of New Guinea. They have served as a basis for the present study, but in addition there have been available numerous collections made by Mrs. M. S. Clemens in Northeast New Guinea, by Mr. C. E. Carr in British New Guinea, and small collections made by the writer and other servicemen stationed in the region during the recent war. Shortly before the war, the Arnold Arboretum was fortunate in receiving practically a complete set of duplicates of the collections made in Netherlands New Guinea in 1940 by R. Kanehira and S. Hatusima. The grasses from this collection proved invaluable in interpreting the new species described by J. Ohwi (56). Much of this large island is still unknown botanically, and it is to be expected that future explorations will yield new records, as well as a considerable number of novelties.

In the present work the systematic order of the genera under the tribes follows, in the main, that of Pilger (59). In characterizing the accepted genera, the original descriptions and later ones by other authors have been consulted, and these descriptions have been studied in association with extensive collections of both Old and New World material. Within recent years there has been a tendency among some agrostologists to subdivide large genera into smaller groups. Where these small genera seem to be reasonably well defined, they have been recognized in this work; when, on the other hand, there seems to be a large amount of intergradation between them and the genera from which they have been segregated, they have been rejected. In general I have taken a rather conservative attitude somewhere, perhaps, midway between that of Hitchcock (34) and Stapf (71), but probably closer to the concept of the former author. These conclusions were, in large part, based upon the study of Malaysian material and hence must be regarded as somewhat tentative. The descrip-

tions of the species herein presented are based on the original diagnoses, supplementary data provided by later authors, and an actual examination of all available specimens. Whenever type material was available, it was consulted and the New Guinea specimens were critically compared with it.

During the course of this study it was found desirable to describe a certain number of new species and varieties and to make some new combinations; at the same time certain species have been reduced to synonymy. In one case a new name had to be given to an old species, since the original specific epithet had an earlier homonym in the proper genus. A list of the new names is given below:

Panicum creperum nom. nov.

Panicum mindanaense Merr. var. *pilosum* var. nov.

Brachiaria fusiformis sp. nov.

Brachiaria subquadripa (Trin.) Hitchc. var. *piliger* (F. Muell. ex Benth.) comb. nov.

Cyrtococcum patens (L.) A. Camus var. *Warburgii* (Mez) comb. nov.

Digitaria abortiva sp. nov.

Setaria montana sp. nov.

Isachne obtecta sp. nov.

Isachne villosa (Hitchc.) comb. nov.

Dimeria monostachya sp. nov.

Dimeria dipteros sp. nov.

Dimeria ciliata Merr. var. *heteromorpha* var. nov.

Eulalia irritans (R. Br.) Kuntze var. *egregia* var. nov.

Microstegium ciliatum (Trin.) A. Camus var. *laxum* (Nees ex Steud.) comb. nov.

Ischaemum littorale sp. nov.

Hemarthria subulata sp. nov.

Eremochloa ciliaris (L.) Merr. var. *elata* var. nov.

Rottboellia rottboellioides (R. Br.) comb. nov.

Chrysopogon filipes (Benth.) comb. nov.

Chrysopogon filipes (Benth.) Reeder var. *arundinaceus* var. nov.

Andropogon micranthus Kunth var. *multicispiculus* (Ohwi) comb. nov.

Andropogon brevifolius Swartz var. *cryptopodus* (Ohwi) comb. nov.

Andropogon spicigerus (S. T. Blake) comb. nov.

Themeda gigantea (Cav.) Hack. var. *novoguineensis* var. nov.

The place of deposit of the type specimens of the new species and varieties is given with the citation of specimens. Since the most representative specimen was always selected as the type, they are of necessity not all in the same herbarium.

The dates of collection of the specimens cited are omitted except in the case of types. The island of New Guinea is divided into two parts by a line running north and south essentially through its center. To the west of this line is Netherlands New Guinea, administered by the Netherlands government; the eastern part is divided into two subdivisions, Northeast New Guinea (Kaiser Wilhelmsland of the Germans) to the north and British New Guinea (Papua) to the south. British and Northeast New Guinea are further subdivided into divisions and districts. In citing the specimens the order is as follows: British New Guinea, Northeast New Guinea, Netherlands New Guinea, New Britain (or other islands of the Bismarck Archipelago), and Solomon Islands. A more exact location is

given whenever possible by using the division or district name. Precise localities are given according to what data are available on the labels. In addition notes concerning habitat are also cited whenever these are available on the labels. This latter practice seemed desirable since the collections from New Guinea are not extensive enough to permit of making a general statement as to the habitat.

Abbreviations used in designating the herbaria in which cited specimens are deposited are as follows:

- A — Arnold Arboretum of Harvard University
- GH — Gray Herbarium of Harvard University
- NY — Britton Herbarium, New York Botanical Garden
- US — United States National Herbarium.

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GRAMINEAE

Subfamily PANICOIDEAE

Spikelets typically 2-flowered, the rachilla not prolonged beyond the upper floret; perfect spikelets with the terminal perfect or pistillate floret

and a staminate or neuter floret below, often reduced to the lemma (in *Isachne* sometimes both florets fertile); one glume (or rarely both glumes) wanting; articulation below the spikelets either in the pedicel, the rachis or at the base of a cluster of spikelets, the spikelets falling entire, either singly, in groups, or together with joints of the rachis; spikelets, or at least the fertile florets, often more or less dorsally compressed.

KEY TO THE TRIBES

1. Spikelets perfect or with staminate or neuter and perfect or pistillate spikelets mixed in the same inflorescence and so arranged that a staminate or neuter spikelet is near a perfect or pistillate spikelet (*Spinifex* dioecious).....I. *Panicaceae*.
2. Spikelets solitary or paired, more or less similar; glumes usually membranous, the first often smaller or sometimes obsolete or wanting; lower lemma mostly like the second glume in texture; upper (fertile) lemma more or less indurated, firmer than the glumes, usually awnlessII. *Andropogoneae*.
2. Spikelets usually paired, one sessile, the other pediceled, similar or more or less unlike, the sessile then usually perfect or pistillate and the pediceled staminate or neuter; lemmas hyaline or membranous, thinner than the glumes, usually awnedIII. *Maydeae*.
1. Spikelets unisexual, the staminate and pistillate in different inflorescences or in different parts of the same inflorescence, the pistillate below; lemmas hyaline or membranous, thinner than the glumes.....III. *Maydeae*.

Tribe I. PANICEAE

Spikelets 2-flowered, the lower floret often reduced, solitary or in pairs, similar, perfect (rarely unisexual), usually falling entire at maturity; glumes usually membranous, the first commonly smaller, sometimes obsolete or wanting (very rarely the second also wanting); lower lemma similar to the second glume, at least in texture, rarely more or less indurated, empty or enclosing a staminate flower, the palea present or wanting (bearing a perfect flower in some species of *Isachne*); upper lemma and palea similar in texture, usually indurated, or at least firmer than the glumes, awnless or rarely with a short straight awn from the tip; stigmas 2, stamens usually 3. Annuals or perennials with herbaceous (rarely woody) culms and spikelets borne on a usually continuous rachis of solitary, digitate or scattered spikes or racemes or in open or contracted, sometimes spikelike panicles.

KEY TO THE GENERA

1. Spikelets subtended or surrounded by 1 to many bristles, or the rachis produced beyond the spikelets.
2. Spikelets perfect.
 3. Bristle single, produced beyond the terminal spikelet of the branch, the branches deciduous, falling with the 1 to several spikelets.....16. *Pseudoraphis*.
 3. Bristles several below each spikelet, or if only one, then the spikelets falling free from the branch.
 4. Bristles united at base into a bur-like involucre permanently enclosing the 2 to several spikelets.....18. *Cenchrus*.
 4. Bristles slender, not united at base.
 5. Spikelets falling free from the bristles; fertile lemma more or less transversely rugose15. *Setaria*.
 5. Spikelets falling with the subtending bristles; fertile lemma smooth.....17. *Pennisetum*.
2. Spikelets unisexual, the staminate and pistillate in spatheate inflorescences on different plants.....20. *Spinifex*.

1. Spikelets neither surrounded by bristles nor the rachis produced beyond the spikelet.
6. Spikelets more or less laterally compressed or oblique.
 7. Fertile lemma strongly dorsally compressed (see also *Oplismenus*).
 8. Second glume inflated-saccate; fertile lemma stipitate.....6. *Sacciolepis*.
 8. Second glume not inflated-saccate; fertile lemma with lateral appendages or excavations at base, not stipitate.....3. *Ichnanthus*.
 7. Fertile lemma more or less laterally compressed.
 9. First glume about half as long as the spikelet; fertile lemma strongly laterally compressed and gibbous on the back.....8. *Cyrtococcum*.
 9. First glume about as long as the spikelet; fertile lemma not strongly gibbous; second glume uncinat-spiny at maturity.....7. *Pseudechinolaena*.
6. Spikelets terete or distinctly dorsally compressed (see also *Sacciolepis myosuroides*).
10. Spikelets dimorphic.
 11. Chasmogamous spikelets borne in small terminal panicles; cleistogamous spikelets borne singly in the axils of the vegetative branches; culms hard and wiry.....9. *Cleistochloa*.
 11. Spikelets of two kinds in the same inflorescence, the upper 4-6 staminate, the lower one or two pistillate or perfect; low strand plants..21. *Thuarea*.
10. Spikelets alike, all perfect.
 12. Glumes equal or nearly so, often falling free from the rest of the spikelet; florets both alike or the lower somewhat larger.....19. *Isachne*.
 12. Glumes usually unequal, the spikelets falling entire; terminal floret perfect, the lower rudimentary or staminate only and with a lemma of the same texture as the glumes.
 13. Glumes or lemmas or both awned, or if short pointed only, the summit of the fertile palea not enclosed (see also *Panicum ambiguum*).
 14. Racemes digitate or approximate; second glume densely ciliate-winged at maturity; fertile lemma awned.....10. *Alloteropsis*.
 14. Racemes simple or compound, not digitate; second glume not ciliate-winged; fertile lemma awnless or with an awn 0.5 mm. long or less.
 15. Glumes awned, awn of the first glume the longer....5. *Oplismenus*.
 15. Glumes awnless or nearly so; sterile lemma awned or awn-tipped.
 16. Sterile lemma 2-lobed, the delicate awn arising from between the lobes; fertile lemma weakly indurated.....22. *Melinis*.
 16. Sterile lemma entire; fertile lemma strongly indurated.....4. *Echinochloa*.
 13. Glumes and lemmas awnless (see also *Echinochloa colonum*).
 17. First glume wanting or much reduced.
 18. Rachilla thickened below the second glume into a ring-like or bead-like callus.....13. *Eriochloa*.
 18. Rachilla not thickened as above.
 19. Fertile lemma strongly indurate, the margins inrolled.....14. *Paspalum*.
 19. Fertile lemma cartilaginous, the margins hyaline, not inrolled.....12. *Digitaria*.
 17. First glume prominent.
 20. Fertile lemma thin or membranous, the palea not enclosed at summit; panicle spikelike.....11. *Hymenachne*.
 20. Fertile lemma chartaceous-indurate, clasping the palea to its summit.
 21. Spikelets in few to many spikelike racemes; first glume turned toward the rachis.....2. *Brachiaria*.
 21. Spikelets in open or contracted panicles, or if in racemes the first glume turned away from the rachis.....1. *Panicum*.

1. *Panicum* L.*Panicum* L., Sp. Pl. 55. 1753.

Spikelets more or less dorsally compressed, in open or compact panicles, rarely in racemes, the back of the fertile lemma turned toward the rachis; glumes 2, membranous, usually unequal, the first often minute, the second usually as long as the spikelet (rarely the first glume as long as the spikelet or the second somewhat shorter); sterile lemma membranous or rarely slightly indurate, usually enclosing a membranous or hyaline palea and sometimes a staminate flower; fertile lemma chartaceous to strongly indurate, the margins inrolled over a palea of the same texture (rarely the margins merely clasping the palea and not strongly inrolled). Annuals or perennials of various habit.

TYPE SPECIES: *Panicum miliaceum* L.

KEY TO THE SPECIES

1. Inflorescence of few to many spikelike racemes rather distant on the axis.
 2. Fertile lemma glabrous, often rugose.
 3. Second glume half to two-thirds as long as the spikelet; fertile lemma acute, minutely beaked.....1. *P. distans*.
 3. Second glume as long as the spikelet.
 4. Spikelets 2-4 mm. long; fertile lemma obtuse, mucronate or awned.
 5. Spikelets 3-4 mm. long; first glume acute, nearly as long as the spikelet.....2. *P. ambiguum*.
 5. Spikelets 2 mm. long; first glume truncate or mucronate, less than half as long as the spikelet.....3. *P. reptans*.
 4. Spikelets 5-7 mm. long; fertile lemma with a short, erose, laterally compressed crest at the apex.....6. *P. zizanioides*.
 2. Fertile lemma pubescent.....15. *P. marginatum*.
 1. Inflorescence not as above, usually a diffuse panicle.
 6. Second glume shorter than the spikelet; fertile lemma weakly indurate.
 7. Glumes unequal, the second half to three-fourths as long as the spikelet.....4. *P. nodosum*.
 7. Glumes about equal, about one-third as long as the spikelet..5. *P. creperum*.
 6. Second glume as long as the spikelet.
 8. First glume as long as the spikelet or nearly so.
 9. Spikelets 2-2.8 mm. long; sheath surface glabrous (pilose in var. *pilosa*)....11. *P. mindanaense*.
 9. Spikelets 3.2-3.5 mm. long; sheaths papillose-hirsute....12. *P. macrocladum*.
 8. First glume half as long as the spikelet or shorter.
 10. Sheaths tuberculate-hispid.
 11. First glume one-third as long as the spikelet, obtuse; blades 8-15 mm. wide9. *P. cambogiense*.
 11. First glume half as long as the spikelet, acute; blades 2-4 mm. wide....10. *P.iale*.
 10. Sheaths not tuberculate-hispid.
 12. Blades 8-25 mm. wide; culms stout, often somewhat woody.
 13. Spikelets 3-4 mm. long; first glume hyaline.....8. *P. paludosum*.
 13. Spikelets 2-2.5 mm. long; first glume membranous.
 14. Ligule membranous; fertile lemma weakly indurated, pale at maturity.....7. *P. auritum*.
 14. Ligule a ring of hairs; fertile lemma strongly indurated, brown at maturity.....13. *P. sarmentosum*.
 12. Blades 3-6 mm. wide; culms slender.
 15. Fertile lemma glabrous; ligule membranous.....14. *P. Archboldii*.
 15. Fertile lemma pubescent; ligule a ring of hairs.....15. *P. marginatum*.

1. *Panicum distans* Trin., Sp. Gram. Ic. 2: pl. 172. 1829; Hitchc., Brittonia 2: 121. 1936. Type from Australia.

Paspalidium distans (Trin.) Hughes, Kew Bull. 1923: 318. 1923.

Perennial; culms glabrous, ascending or spreading, 20-70 cm. tall; sheaths shorter than the internodes, ciliate on the overlapping margins; ligule membranous, ciliate, about 0.5 mm. long; blades linear, flat, as much as 15 cm. long, 2-5 mm. wide, sharply narrowed to a very short petiole-like base, more or less scabrous, especially on the margins; inflorescence as much as 20 cm. long, consisting of several to many short racemes 1-4 cm. distant on the slender scabrous axis; basal racemes as much as 3 cm. long, sometimes with a few short branches, the apical racemes reduced to a few spikelets; spikelets crowded, glabrous, very turgid, about 2 mm. long, the pedicels discoid-tipped; first glume about one-third the length of the spikelet with 3 strong nerves (sometimes with 1 or 2 additional pairs of faint nerves); second glume about two-thirds the length of the spikelet, 7-nerved; sterile lemma as long as the spikelet, 5-nerved, the palea poorly developed; fertile lemma minutely beaked, transversely rugose on the lower half, granular-roughened above, the margins strongly inrolled.

BRITISH NEW GUINEA: Western Division: Wuroi, Oriomo River, alt. 10-30 m., *Brass* 5228 (GH, US) (damp situations on savannah); Daru Island, *Brass* 6387 (A, US) (occasional on wet soils in savannah forests); Gaima, Lower Fly River, *Brass* 2343 (A, US) (damp parts of savannah forest); Tarara, Wassi Kussa River, *Brass* 8696 (A, US) (weed in villages).

Australia and New Guinea.

2. *Panicum ambiguum* Trin., Mém. Acad. St. Petersb. VI. Sci. Nat. 1: 245. 1834; Hack., Bot. Jahrb. 6: 234. 1855. Based on *Urochloa paspaloides* Presl.

Urochloa paspaloides: Presl, Rel. Haenk. 1: 318. 1830 (non *Panicum paspaloides* Pers. 1805, nec Hayata 1911); Scribn., Missouri Bot. Gard. Rep. 10: 54. pl. 14. 1899. Type from the Philippines.

Brachiaria ambigua (Trin.) A. Camus in Lecomte, Fl. Gén. Indo-Chine 7: 433. 1922.

Brachiaria paspaloides (Presl) C. E. Hubb., Hook. Ic. 34: sub pl. 3363. 1938.

Urochloa ambigua (Trin.) Pilger, Nat. Pflanzenfam. ed. 2. 14e: 35. 1940.

Culms ascending to decumbent and creeping, branching, up to 1 meter or more long, glabrous except for the more or less pubescent nodes; sheaths slightly shorter than the internodes, glabrous to more or less pubescent, the margins often ciliate, especially toward the ligule; ligule about 1 mm. long, consisting of a row of whitish hairs or the lower part somewhat membranous; blades flat, 8-15 cm. long, 5-8 mm. wide, glabrous to more or less pubescent, often papillose-hispid along the nerves; inflorescence of 3-7 racemes (rarely only 2), 2-4 cm. long, alternate and 1-2 cm. distant along the slender flattened axis, this more or less pubescent and scabrous along the margins; rachis about 0.75 mm. wide, pubescent to nearly glabrous, the margins scabrous; spikelets paired, glabrous, short-pedicellate, 3-4 mm. long; glumes 5-nerved, the first about four-fifths as long as the second, this equaling the spikelet; sterile lemma 5-nerved, slightly indurate and faintly transversely-rugose on the back, enclosing a minute palea; fertile lemma stramineous, indurate, transversely-rugose and with a terminal awn about 0.5 mm. long, this enclosed within the tip of the sterile lemma.

NORTHEAST NEW GUINEA: Morobe District: Finschhafen, *Clemens* 4280 (A, US). NETHERLANDS NEW GUINEA: Triton Bay, *Hombroon* 1841 (US).

3. *Panicum reptans* L., Syst. Nat. ed. 10. 2: 870. 1759; Hitchc. and Chase, Contr. U. S. Nat. Herb. 15: 36. fig. 17. 1910; Chase, Jour. Arnold Arb. 20: 308. 1939. Type from Jamaica.

- Panicum prostratum* Lam., Tabl. Encycl. 1: 171. 1791; K. Schum. and Lauterb., Nächtr. Fl. Deutsch. Schutzgeb. Südsee 56. 1905. Type from Santo Domingo.
Brachiaria prostrata (Lam.) Griseb., Abh. Boehm. Ges. Wiss. 7: 263. 1857.
Urochloa reptans (L.) Stapf in Prain, Fl. Trop. Afr. 9: 601. 1920.
Brachiaria reptans (L.) C. A. Gard. and C. E. Hubb., Hook. Ic. 34: sub pl. 3363. 1938.

Culms slender, decumbent or prostrate, the upright flowering branches 10–40 cm. tall, glabrous except for the more or less pubescent nodes; sheaths shorter than the internodes, glabrous to somewhat papillose-pilose, the margins ciliate; ligule a row of white hairs about 1 mm. long; blades lanceolate, cordate at base, 1–6 cm. long, 4–10 mm. wide, glabrous to sparsely hispid, the margins scabrous; racemes 3–10, 1–3 cm. long, erect or spreading, somewhat distant on the scabrous, angled axis; spikelets crowded, about 2 mm. long, ovate, acute, the pedicels discoid-tipped and often with long stiff hairs as long as the spikelets; first glume about 0.5 mm. long, hyaline, nerveless, truncate or apiculate; second glume as long as the spikelet, 7–9-nerved; sterile lemma 5-nerved and with a well-developed palea; fertile lemma transversely rugose, obtuse and mucronate, the mucro slender.

BRITISH NEW GUINEA: Central Division: Kanosia, Carr 11091 (NY) (open clearings in forest); Western Division: Daru Island, Brass 6303 (A, US) (matted on damp soil in native garden clearings). NORTHEAST NEW GUINEA: Weinland in 1889–91 (US); Morobe District: Four miles south of Langemak Bay, near Finschhafen, Sawyer 91 (A); Kajabit, Clemens 10475 (US). Widely distributed in the tropics and subtropics.

4. *Panicum nodosum* Kunth, 4 Rev. Gram. 1: Suppl. 9. 1830; K. Schum. and Lauterb., Nächtr. Fl. Deutsch. Schutzgeb. Südsee 56. 1905. Based on *P. multinode* Presl. *Panicum multinode* Presl, Rel. Haenk. 1: 303. 1830 (non Lam. 1797). Type from the Philippines.
Panicum Arnottianum Nees in Steud., Syn. Pl. Glum. 1: 59. 1854. Habitat in India and Java.
Hemigymnia multinodis (Presl) Stapf in Prain, Fl. Trop. Afr. 9: 742. 1920.
Hemigymnia Arnottiana (Nees) Stapf in Prain, Fl. Trop. Afr. 9: 742. 1920.
Ottochloa nodosa (Kunth) Dandy, Jour. Bot. 69: 55. 1931.
Ottochloa Arnottiana (Nees) Dandy, Jour. Bot. 69: 55. 1931; Henr., Blumea 4: 531. 1941.

Culms creeping, slender, sparingly branching from the lower nodes, glabrous; sheaths more or less papillose-pilose, ciliate on the margins; ligule membranous, about 0.3 mm. long; blades thin, lanceolate, rounded to subcordate at base, 4–12 cm. long, 5–12 mm. wide, glabrous to more or less papillose-pilose; panicle contracted to more or less open, the slender branches angled, scabrous on the angles; spikelets lanceolate, glabrous to more or less pubescent, 2.8–3.2 mm. long; first glume 1–1.5 mm. long, acute, 3–5-nerved; second glume half to three-fourths as long as the spikelet, 5–7-nerved; sterile lemma equaling the spikelet, 7-nerved; fertile lemma pale, chartaceous-indurate, the tip laterally compressed into a tiny crest.

BRITISH NEW GUINEA: Central Division: Kanosia, Carr 11032 (NY); Western Division: Daru Island, Brass 6260 (A, US) (abundant and covering ground under shade of rain-forest margins); Goodenough Island: Ma-

4 For a discussion of this binomial and more complete synonymy, see Merrill, Bull. Torr. Bot. Club 60: 637. 1933.

launa Creek, *Burcham 128* (US) (scanty moist soil along creek bed and banks).
Africa, Indo-Malayan region to Australia and New Guinea.

5. *Panicum creperum* nom. nov.

Hemigymnia fusca Ridley, Fl. Malay Pen. 5: 228. 1928. Type from Malaya.

Ottochloa fusca (Ridley) Dandy, Jour. Bot. 69: 55. 1931; Henr., Blumea 4: 531. 1941.

Perennial; culms creeping, somewhat woody below, the ascending branches 30–120 cm. tall; sheaths shorter than the internodes, glabrous, often ciliate on the margins; ligule membranous, about 0.3 mm. long; blades glabrous, lanceolate, 10–20 cm. long, 7–15 mm. wide; panicle nodding, 15–25 cm. long, the slender, angled, scabrous branches ascending, as much as 14 cm. long; spikelets glabrous, 2.5–3 mm. long, brown, crowded in short racemes on the panicle branches; glumes about equal or the second slightly longer, about one-third as long as the spikelet, acute or obtuse; sterile lemma equaling the spikelet or slightly shorter; fertile lemma chartaceous-indurate, the tip laterally compressed into a tiny crest.

BRITISH NEW GUINEA: Central Division: Veiya, *Carr 11622* (US, NY) (river bank).

Indo-China, Malaya, Sumatra to New Guinea.

Closely related to *Panicum nodosum* Kunth, but differing in the somewhat woody culms, larger blades, and the shorter nearly equal glumes.

Since the specific epithet "*fuscum*" is preoccupied in *Panicum*, a new name is proposed.

6. *Panicum zizanioides* H.B.K., Nov. Gen. et Sp. 1: 100. 1815; Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 325. fig. 367. 1910; Chase, Jour. Arnold Arb. 24: 66. 1943. Type from Colombia.

Panicum oryzoides Swartz, Prodr. Veg. Ind. Occ. 23. 1788 (non Ard. 1764): Type from Jamaica.

Acroceras oryzoides (Swartz) Stapf in Prain, Fl. Trop. Afr. 9: 622. 1920.

Acroceras zizanioides (H.B.K.) Dandy, Jour. Bot. 69: 54. 1931.

Perennial; culms decumbent at base, rooting and rather sparsely branching from the lower nodes, rather robust, the flowering portion ascending or spreading, as much as 1 meter long, glabrous or with a few appressed hairs below the nodes; sheaths ciliate on the margin, sometimes papillose-hirsute toward the summit, otherwise glabrous; ligule membranous, about 0.5 mm. long; blades ovate-lanceolate, 4–15 cm. long, 10–30 mm. wide, subcordate at base, glabrous or rarely with a few appressed hairs; panicle 10–25 cm. long, composed of a few ascending or appressed, stiff, slender, angled, scabrous branches, with short-pediceled more or less secund spikelets; spikelets 5.5–7 mm. long, rather turgid; first glume about two-thirds as long as the spikelet, acute, 3–5-nerved; second glume and sterile lemma equal, abruptly contracted into a short keeled tip, 5-nerved, the lateral nerves of the lemma more or less obscure below the tip; sterile palea about two-thirds as long as the lemma; fertile lemma smooth and shining and with a short, erose, laterally compressed crest at the apex, the tip of the palea similarly compressed and bent outward.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, alt. 50 m., *Brass 13946* (A, US) (abundant in semi-open swampy forest of river flood plain).

Tropical America, Africa, India, and New Guinea.

7. *Panicum auritum* Presl ex Nees, Agros. Bras. 176. 1829; Presl, Rel. Haenk. 1: 305.

1830; Scribn., Missouri Bot. Gard. Rep. 10: 46. *pl.* 15. 1899; Chase, Jour. Arnold Arb. 24: 86. 1943. Type from Luzon, Philippines.

Hymenachne aurita (Presl ex Nees) Balansa, Jour. de Bot. 4: 144. 1890; 5 Backer in Heyne, Nutt. Pl. Ned.-Ind. ed. 2. 1: 238. 1927.

Culms glabrous, ascending or spreading, often rather stout, as much as 2 meters tall; sheaths distinctly shorter than the internodes, glabrous or sometimes ciliate on the margins; ligule membranous, about 0.5 mm. long or less; blades lanceolate, acuminate, 10–20 cm. long, 8–25 mm. wide, glabrous, rather firm, subcordate at base, the margins scabrous; panicle 20–40 cm. long, contracted or the branches stiffly spreading, these and the pedicels scabrous; spikelets glabrous, about 2.5 mm. long, broadly lanceolate, acuminate; first glume 3-nerved, about one-third as long as the spikelet, acute or sometimes minutely apiculate; second glume and sterile lemma subequal, 5-nerved, the lemma usually a little shorter, epaleate or with a much reduced palea; fertile lemma chartaceous, thin, stramineous, the margins clasping the palea but not inrolled or only weakly so, the tip of the palea sometimes free.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, alt. 50 m., *Brass* 13942 (A, US) (common in swamp forests of river silt plains).

Indo-Malayan region to New Guinea.

8. *Panicum paludosum* Roxb., Hort. Beng. S. 1814. nomen. Fl. Ind. 1: 310. 1820. descr.; K. Schum., Notizbl. Bot. Gart. Berlin 1: 208. 1896. Type from India.

Aquatic perennial; culms decumbent, floating or rooting in the mud, soft, often 1 cm. in diameter, the flowering portion erect or ascending, as much as 1 meter tall; sheaths glabrous, longer than the internodes; ligule a ring of hairs about 2 mm. long; blades thin, 10–30 cm. long, 8–16 mm. wide, scabrous on the margins, scaberulous on the upper surface, nearly smooth below; panicle partly included in the uppermost sheath, at first contracted, finally very diffuse, 15–30 cm. long, the branches angled and scabrous; spikelets very numerous, glabrous, lanceolate, acuminate, 3–4 mm. long; first glume hyaline, acute, about 1 mm. long, with a faint midnerve and sometimes a pair of obscure lateral nerves; second glume and sterile lemma equal or subequal, 7–9-nerved, the lemma enclosing a hyaline palea about two-thirds its length; fertile lemma about 2.5 mm. long, smooth and shining, pale at maturity.

BRITISH NEW GUINEA: Western Division: Middle Fly River, Lake Daviumbu, *Brass* 7647 (A) (swampy lakeshore, uncommon). NORTHEAST NEW GUINEA: Morobe District: Near Kajabit Mission, *Clemens* 10696 (US).

India to Southern China, Malaya, Philippines, Australia and New Guinea.

9. *Panicum cambogiense* Balansa,⁶ Jour. de Bot. 4: 142. 1890. Type from Indo-China.

Panicum caesium Nees, Jour. Bot. Kew Misc. 2: 97. 1850 (non Nees 1836); K. Schum. and Lauterb., Fl. Deutsch. Schutzgeb. Südsee 179. 1901. Type from the Philippines.

Panicum reticulatum Thwaites in Trimen, Jour. Bot. 23: 271. 1885 (non Torr. 1852, nec Griseb. 1857). Type from Ceylon.

Panicum cruciabile Chase, Jour. Arnold Arb. 20: 309. 1939. Based on *P. reticulatum* Thwaites.

⁵ Given as "*H[ymenachne] aurita* Presl." but presumably based on *Panicum auritum* Presl ex Nees.

⁶ For a further discussion of the accepted binomial, see Henrard, *Blumea* 3: 444. 1940.

Robust annual: culms 60–100 cm. tall, rather stout, more or less tuberculate-hispid, especially on the portion not covered by the sheaths, the nodes bearded; sheaths somewhat keeled, especially toward the summit, densely tuberculate-hispid, the hairs stiff and breaking off readily; ligule a row of tawny hairs about 1 mm. long; blades glabrous, as much as 25 cm. long, 8–15 mm. wide; panicle open, 25–40 cm. long, the branches flexuous; spikelets glabrous, about 2 mm. long; first glume about one-third as long as the spikelet, clasping, obtuse, 7-nerved; second glume and sterile lemma equal, 9–11-nerved, the nerves connected here and there by faint cross-nerves giving a reticulate appearance; sterile palea as long as the lemma, hyaline except for the two marginal nerves; fertile lemma smooth and shining, olive-brown at maturity.

BRITISH NEW GUINEA: Northern Division: Ambasi, Copeland King in 1942 (US); Western Division: Strickland River, W. Bauerlen 61 (US). **NORTHEAST NEW GUINEA:** Dreger Harbor (Finschhafen area), Reeder 904 (A, US) (low wet ground). **SOLOMON ISLANDS:** Bougainville: Kajewski 1897 (GH, US).

Ceylon, Burma, the Philippines, New Guinea, and the Solomon Islands.

10. *Panicum viae* Chase, Jour. Arnold Arb. 20: 310. 1939. Type from New Guinea.

Perennial: culms tufted, erect or ascending, 50–100 cm. tall, sparingly branching, tuberculate-hispid on the portions not covered by the sheaths; sheaths much shorter than the internodes, tuberculate-hispid like the nodes and the exposed parts of the culm; ligule a row of stiff hairs about 1 mm. long; blades flat to subinvolute, rather stiff, 10–20 cm. long, 2–4 mm. wide (blades on the basal sheaths shorter and narrower), papillose-pilose to tuberculate-hispid; panicle open, 20–30 cm. long, the branches flexuous but rather stiff, angled, scabrous, spikelet-bearing toward the ends; spikelets glabrous, 2 mm. long, slightly less than 1 mm. wide, plump, abruptly short-pointed; first glume half as long as the spikelet, clasping, acuminate, with a strong midnerve and 1 or 2 additional pairs of obscure lateral nerves; second glume and sterile lemma equal, 7-nerved; sterile palea hyaline, about three-fourths as long as the lemma; fertile lemma smooth and shining, olive-brown at maturity, the 5 nerves showing as pale stripes.

BRITISH NEW GUINEA: Central Division: Rona, Laloki River, alt. 450 m., Brass 3631 (A, TYPE US) (fairly common on roadsides); Kanosia, Carr 11043, 11104 (US, NY) (open savannah lands); ? Division: Barawara, MacGregor 21 (US). Endemic.

Related to *Panicum cambogiense*, but that species is a robust annual with much broader, glabrous leaves and more turgid spikelets in which the first glume is only about one-third as long as the spikelet and is obtuse rather than acuminate. Both species have tuberculate-hispid sheaths. The type specimen (Brass 3631) was cited as *Panicum tuberculatum* Presl by Hitchcock (Brittonia 2: 122. 1936).

11. *Panicum mindanaense* Merrill, Philip. Jour. Sci. Bot. 1: Suppl. 360. 1906; Hitchc., Brittonia 2: 121. 1936. Type from Mindanao, Philippines.

Culms caespitose, glabrous, erect or ascending, 20–80 cm. tall; sheaths shorter than the internodes, often somewhat papillose, especially toward the summit, glabrous or with ciliate margins; ligule a ring of stiff hairs 0.5–1 mm. long; blades flat, ascending, mostly 5–15 cm. long, 2–4 mm. wide, glabrous or essentially so; panicle diffuse, 10–15 cm. long, the

slender scabrous branches rather distant, spikelet-bearing toward the ends; spikelets often purplish, 2–2.8 mm. long, glabrous or the midnerve of the glumes scabrous; first glume as long as the spikelet or nearly so, clasping, acuminate, 5–7-nerved, separated from the second glume by a distinct internode; second glume and sterile lemma equal, acuminate, 5–7-nerved, the lemma with a hyaline palea about half its length; fertile lemma elliptic, smooth and shining.

BRITISH NEW GUINEA: Western Division: Dagwa, Oriomo River, alt. 40 m., *Brass* 5960 (GH, US) (damp situations on creek flats); Mabaduan, *Brass* 6485 (A, US) (common on old grass-grown garden lands, especially on wet soils); Lake Daviumbu, Middle Fly River, *Brass* 7522, 7851, 7852 (A, US) (savannahs; tufted on patches of hard ground). NORTHEAST NEW GUINEA: Morobe District: Dreger Harbor, near Finschhafen, *Reeder* 905 (A, US) (low, wet ground in the open).

Philippines and New Guinea.

Brass 6485, cited as “? *Panicum papuanum* Mez” by Chase (17, p. 309), is a slightly more robust plant than the others and has blades as much as 20 cm. long. The original description of *P. papuanum* states that the glumes are 7-nerved and that the sterile lemma (glume III) is 9-nerved. *Brass* 6486 has both glumes and sterile lemma 5-nerved. The spikelets are identical with those of a type duplicate of *P. mindanaense*.

11a. *Panicum mindanaense* Merr. var. *pilosum* var. nov.

A typo vaginis laminisque dense pilosis differt.

NETHERLANDS NEW GUINEA: Waren, *Kanehira & Hatusima* 13093 (A, TYPE) March 26, 1940 (in open dry rocky grass field).

Differs from the species in having the sheaths and blades densely pilose.

12. *Panicum macrocladum* Chase, Jour. Arnold Arb. 20: 308. 1939. Type from New Guinea.

Panicum Braunii Mez, Bot. Jahrb. 56: Beibl. 125: 5. 1921 (non Steud. 1854). Type from the Bismarck Archipelago.

Culms glabrous, erect or ascending, about 1 meter tall, the nodes often black; sheaths much shorter than the internodes, papillose-hirsute, the upper sometimes nearly glabrous, at least on the lower half; ligule a dense row of hairs about 2 mm. long; blades flat, 18–30 cm. long, 4–7 mm. wide, loosely hirsute on both surfaces or scabrous only toward the attenuate apex, the margins scabrous; panicle partly included in the upper sheath, 40–50 cm. long, nodding, with numerous subcapillary compound branches as much as 25 cm. long, the slender angled axis and branches scabrous, the spikelets mostly aggregated toward the ends of the branchlets; spikelets ovate-lanceolate, acuminate, glabrous, 3.2–3.5 mm. long; first glume from one-fourth shorter to nearly as long as the spikelet, 5–7-nerved, broad, clasping, acuminate; second glume and sterile lemma subequal, 5–7-nerved; fertile lemma 2 mm. long, elliptic, smooth and shining.

BRITISH NEW GUINEA: ? Division: Kuba Kuba, *MacGregor* 18 (US); Western Division: Daru Island, *Brass* 6350 (A, US) (on swampy ground in savannah forest); Mabaduan, *Brass* 6568 (A, TYPE, US) (sporadic on damp soil in savannah forest).

Endemic.

Closely related to *Panicum mindanaense* Merr., from which it differs in being much coarser and taller, with longer and broader leaves and larger spikelets.

13. *Panicum sarmentosum* Roxb., Hort. Beng. 8. 1814, nomen, Fl. Ind. 1: 311. 1820, descr.; K. Schum. and Lauterb., Fl. Deutsch. Schutzgeb. Südsee 179. 1901. Type from Sumatra.

Panicum incommum Trin., Gram. Pan. 200. 1826, Sp. Gram. Ic. 2: pl. 232. 1829; Chase, Jour. Arnold Arb. 20: 311. 1939. Type from the Philippines.

Perennial; culms branching, woody, scandent or rambling, 1 to several meters long (up to 15 meters ex auct.), glabrous or somewhat pubescent, especially below the panicle; sheaths shorter than the internodes, nearly glabrous to rather densely pubescent, especially on the collar, apparently becoming glabrous in age; ligule a ring of tawny hairs scarcely 1 mm. long; blades glabrous to more or less pubescent, linear-lanceolate, 12–30 cm. long, 8–25 mm. wide, acuminate, the base abruptly narrowed at the junction with the sheath; panicle open, 15–30 cm. long, the main axis erect, pubescent or villous, the branches terete, spreading, often very diffuse and implicate, sometimes viscid; spikelets ovoid, about 2 mm. long, obtuse or subacute, glabrous or with a few short hairs near the tip of the glumes and sterile lemma; first glume half the length of the spikelet or more, acute, 3-nerved; second glume and sterile lemma equal, 5-nerved, the sterile lemma with a palea about two-thirds its length; fertile lemma smooth and shining, angled on the back, brown at maturity.

BRITISH NEW GUINEA: Central Division: Mafulu, alt. 1250 m., *Brass* 5208 (US) (rambling grass in secondary forest); Koitaki, *Carr* 12525 (NY) (edge of forest); Western Division: Lake Daviumbu, Middle Fly River, *Brass* 7957 (A, US) (large entangling grass in old village clearings); Mt. Musgrave, *MacGregor* 41 (US); ? Division: Lone Range, *Chalmers* 72 (US); Without precise locality: *Chalmers* 42 (US); *Hartman* 73 (US); *MacGregor* 12 (US). NORTH-EAST NEW GUINEA: Morobe District: *Clemens* 4303 (A).

Indo-Malayan region, New Guinea, and Australia.

Roxburgh based his description on plants growing in the Calcutta Botanical Garden, where the species had been introduced from Sumatra. Chase (17, p. 311) and J. Ohwi (56, p. 5) take up the name *Panicum incommum* Trin. (described from the Philippines) for the New Guinea plants. Chase (loc. cit.) states: "*Panicum sarmentosum* Roxb., described from Sumatra, has a larger much more open panicle than *P. incommum*, the panicle branches not viscid. It is far less common and less widely distributed than *P. incommum*." Study of numerous specimens from the Indo-Malayan region does not support the view that these two species are distinct. There is nothing in the size or structure of the spikelets that would serve to separate two species from the complex, and the panicles vary from open and with spreading branches to more contracted with the branches more or less implicate. There seem to be all degrees of variation between these two extremes. The viscid panicle branches are not always associated with the implicate character. From the evidence at hand it seems to the writer that we have here not two species, one with a wide range, the other rather restricted, as Mrs. Chase suggested, but rather one wide-ranging polymorphic species.

14. *Panicum Archboldii* Hitchc., Brittonia 2: 121. 1936. Type from New Guinea.

Perennial; culms erect, stiff, hard, glabrous, about 1.5 meters tall; sheaths glabrous, shorter than the internodes, somewhat keeled, especially

toward the summit; ligule membranous, about 0.5 mm. long; blades glabrous, erect or ascending, flat to involute, 10–25 cm. long, 3–6 mm. wide; panicle erect, contracted, 10–25 cm. long, the axis angled, scabrous, the main branches slender, appressed, distant but more or less overlapping, the lower as much as 9 cm. long, bearing short-pedicelled, closely arranged spikelets mostly toward one side, the branches and terete pedicels minutely scabrous; spikelets 2 mm. long, glabrous, oblong-elliptic; first glume ovate, acute, 5-nerved, less than half as long as the spikelet; second glume and sterile lemma equal, 5-nerved, the lemma with a much reduced hyaline palea; fertile lemma chartaceous-indurate, stramineous, acute.

BRITISH NEW GUINEA: Western Division: Dagwa, Oriomo River, alt. 40 m., *Brass* 5923 (US, TYPE COLL.) (shallow margins of a large lagoon); Daru Island, *Brass* 6342 (A, US) (occasional pure stands in swampy savannah forests); Mabaduan, *Brass* 6484 (A, US) (common in dense grass cover of old garden lands).

Sumatra and New Guinea.

The original description of this species states that the blades are 5–15 cm. long and that the spikelets are loosely arranged on the panicle branches. Examination of a duplicate of the type specimen shows that the blades are, rather, 10–22 cm. long, and that the spikelets are very densely arranged on the panicle branches.

15. *Panicum marginatum* R. Br., Prodr. Fl. Nov. Holl. 1: 190. 1810; Trin., Sp. Gram. Ic. 2: *pl.* 209. 1829; Chase, Jour. Arnold Arb. 20: 312. 1939. Type from Australia.

Entolasia marginata (R. Br.) Hughes, Kew Bull. 1923: 331. 1923.

Perennial; culms ascending or spreading, sparingly branching below, 40–90 cm. tall, essentially glabrous; sheaths distinctly shorter than the internodes, glabrous to rather densely papillose-pilose (sometimes only papillose); ligule a row of hairs about 1 mm. long; blades mostly 3–9 cm. long, 2–6 mm. wide (often much reduced, especially on the basal sheaths), scabrous to more or less pubescent, the base narrowed into a short brownish petiole-like base; panicle erect, contracted, 3–8 cm. long; spikelets glabrous, 3–3.5 mm. long, about 1 mm. wide; first glume about 0.5 mm. long, hyaline and nerveless; second glume and sterile lemma equal, membranous, 5-nerved; fertile lemma and palea white-sericeous.

BRITISH NEW GUINEA: Western Division: Tarara, Wassi-Kussa River, *Brass* 8654 (A, US) (forming a wiry, tangled groundcover in riverbank dry scrub). Australia and New Guinea.

2. *Brachiaria* (Trin.) Griseb.

Brachiaria (Trin.) Griseb. in Ledeb., Fl. Ross. 4: 469. 1853.

Panicum section *Brachiaria* Trin., Mém. Acad. St. Petersb. VI. Sci. Nat. 3(2): 194. 1834.

Spikelets dorsally compressed, solitary or in pairs, alternate in two rows along one side of a trigonal or narrowly winged rachis, the back of the fertile lemma turned away from it; first glume one-third to half as long as the spikelet; second glume and sterile lemma similar, 5–7-nerved, the lemma usually with a palea and sometimes bearing a staminate flower; fertile lemma indurate, dorsally convex, obtuse, acute, or mucronate, smooth or rugose, the margins inrolled. Annuals or perennials with terminal panicles of two to several spikelike racemes racemose along a main axis.

TYPE SPECIES: *Brachiaria eruciformis* (J. E. Smith) Griseb. (*Panicum eruciforme* J. E. Smith).

KEY TO THE SPECIES

1. First glume clasping the base of the spikelet, the margins overlapping; fertile lemma transversely rugose.....1. *B. subquadriflora*.
1. First glume not clasping the spikelet; fertile lemma papillose-rugose.
 2. Spikelets about 2.5 mm. long, acute; fertile lemma not mucronate.....2. *B. coccosperma*.
 2. Spikelets about 3 mm. or more long, acuminate or awned; fertile lemma mucronate.
 3. Spikelets silky-sericeous; sterile lemma awned.....4. *B. holosericea*.
 3. Spikelets not silky-sericeous (sometimes with a few silky hairs at apex); sterile lemma awnless.....3. *B. fusiformis*.
1. *Brachiaria subquadriflora* (Trin.) Hitchc., Lingnan Sci. Jour. 7: 214. 1929; Chase, Jour. Arnold Arb. 20: 308. 1939.
Panicum subquadriflorum Trin., Gram. Pan. 145. 1826, Sp. Gram. Ic. 2: pl. 186. 1829. "Inss. Marian. Ind. or."
Panicum miliiforme Presl, Rel. Haenk. 1: 300. 1830; Scribn., Missouri Bot. Gard. Rep. 10: 47. pl. 20. 1899. Type from Luzon, Philippines.
Brachiaria miliiforme (Presl) Chase, Contr. U. S. Nat. Herb. 22: 35. 1920.

Culms slender, straggling or suberect, the ascending branches 20–60 cm. tall; sheaths mostly shorter than the internodes, rather loose, glabrous or somewhat pubescent, the margins usually more or less ciliate; ligule a row of hairs about 1 mm. long; blades 5–17 cm. long, 4–10 mm. wide, glabrous or sparsely pilose, the margins scabrous; racemes 3–6, spreading, rather distant along the glabrous or sparsely hairy axis, the rachis flattened, glabrous or sometimes with stiff hairs; spikelets 3–4 mm. long, glabrous, acute, solitary, subsessile on the rachis; first glume about 1.5 mm. long, clasping the base of the spikelet, the margins overlapping; second glume 7-nerved; sterile lemma 5-nerved, equaling the second glume, sometimes enclosing a hyaline palea; fertile lemma pale, transversely rugose.

BRITISH NEW GUINEA: Western Division: Daru Island, *Brass* 6301 (A, US) (common as a weed in native gardens); Northern Division: Oro Bay, *Reeder* 841 (A, US) (growing thickly in sand along seashore, just above high tide mark). NETHERLANDS NEW GUINEA: Waren, 50 miles south of Manokwari, *Kanehira & Hatusima* 14144 (A).

This species has been referred to *Panicum distachyon* L. of India, a smaller species with ovate-lanceolate blades in which the racemes are usually two and the peduncle is pilose near the summit.

- 1a. *Brachiaria subquadriflora* (Trin.) Hitchc. var. *pilifera* (F. Muell. ex Benth.) comb. nov.
Panicum piligerum F. Muell. ex Benth., Fl. Austral. 7: 477. 1878. Type from Australia.
Brachiaria pilifera (F. Muell. ex Benth.) Hughes, Kew Bull. 1923: 315. 1923.

Differs from the species in having the second glume and sterile lemma pubescent. The first glume is glabrous.

BRITISH NEW GUINEA: Central Division: Hisiu, *Carr* 11398 (NY) (open places near the seashore; grass about two feet tall).

2. *Brachiaria coccosperma* (Steud.) Stapf ex Backer, Handb. Fl. Java 2: 147. 1928. (As synonym of *Panicum coccospermum* Steud.)
Panicum coccospermum Steud., Syn. Pl. Glum. 1: 62. 1854. Type from India.

Annual; culms slender, usually decumbent and branching below, 10–35 cm. tall, subglabrous to more or less pubescent, the nodes white-bearded; sheaths usually shorter than the internodes, sparsely to densely woolly-pubescent, the margins ciliate; ligule a row of white hairs about 0.3 mm. long; blades ovate-lanceolate, subcordate, 1–4 cm. long, 3–10 mm. wide, soft-pubescent on both surfaces, one of the margins undulate, the other pectinate-scabrous; racemes 4–8, 1–3 cm. long, the rachis more or less pubescent, scabrous on the angles; pedicels solitary above, often paired below, short, more or less pubescent and bearing stiff hairs as much as 0.5 mm. long; spikelets glabrous to densely soft-pubescent, about 2.5 mm. long; first glume 3-nerved, about half as long as the spikelet, acute; second glume and sterile lemma equal, acute, 5-nerved, the lemma enclosing a well developed palea but no flower; fertile lemma pale, elliptic, longitudinally striate and minutely papillose-rugose.

NORTHEAST NEW GUINEA: Morobe District: Wantoat, *Clemens* (sine coll. no.), Feb. 21, 1940 (US). [Form with glabrous spikelets.]

This species is variable in that the spikelets may vary from glabrous to rather densely pubescent. The foliage also varies in this respect, but to a lesser degree.

Some authors have considered this species as a synonym of *Brachiaria villosa* (Lam.) A. Camus (*Panicum villosum* Lam., Tabl. Encycl. 1: 173. 1791), but that species has obtuse glumes, a sterile lemma enclosing a well developed staminate flower, and both sterile and fertile lemmas mucronate. The tip of the fertile lemma is scabrous and clothed with white hairs on the margin near the apex.

3. *Brachiaria fusiformis* sp. nov. PLATE I.

Annual, 15–40 cm. alta; culmis gracilibus, glabris vel plus minusve pubescentibus, adscendentibus vel decumbentibus, nodis pubescentibus eis inferioribus radicantibus; vaginis quam internodiis fere brevioribus, plus minusve pubescentibus, callo et marginibus dense pilosis; ligula ad ciliarium seriem fere 0.6 mm. longam reducta; laminis ovato-lanceolatis, subcordatis, 1.5–3.5 cm. longis, 3–7 mm. latis, glabris vel plus minusve puberulentibus, alter margine undulato, alter pectinato-scabro; racemis 3–10, 0.5–2 cm. longis, rhachi angulata, puberulente et pilis paucis rigidis praedita; pedicellis solitariis, 0.5–1 mm. longis, puberulentibus et apicem versus pilis rigidibus obtectis; spiculis fusiformibus, circiter 3 mm. longis, pilosis, apicem versus pilis paullo longioribus; gluma prima acuta, 3-nervia, quam spicula duplo brevior; gluma secunda et lemmate sterili subaequantibus, 5-nervis, acuminatis, lemmate quam gluma paullo longiore; palea sterili angusta, scariosa; lemmate fertili striata papillis ordinibus dispositis.

BRITISH NEW GUINEA: Central Division: Rona, Laloki River, alt. 450 m., *Brass* 3639 (GH, TYPE, US) April, 1933 (common on rocky savannah slopes).

Some additional specimens in the U. S. National Herbarium which seem to represent this same species are: Luzon: Viscaya Province: *M. Ramos* [Philip. Bur. Sci. No. 8214]; *Clemens* 18000; Benguet Province: *R. S. Williams* 1963; Lepanto District, *Merrill* 4459.

The new species is related to *Brachiaria coccasperma*, but that species has shorter, acute spikelets with the fertile floret elliptic and acute rather than obovate and distinctly mucronate. This is the species reported as *B. villosa* (Lam.) A. Camus, by Hitchcock (35, p. 121).

4. *Brachiaria holosericea* (R. Br.) Hughes, Kew Bull. 1923: 315. 1923; Hitchc., Brittonia 2: 121. 1936.

Panicum holosericeum R. Br., Prodr. Fl. Nov. Holl. 1: 190. 1810; Trin., Sp. Gram. Ic. 2: pl. 173. 1829. Type from Australia.

Culms erect from a branching base, 40–60 cm. tall, glabrous or sparsely pubescent, the nodes densely villous; sheaths, at least the lower, overlapping, sparsely stiff-pilose, densely so along the margins; ligule a row of stiff hairs about 1.5 mm. long; blades lanceolate, 3–5 cm. long, 3–5 mm. wide, stiff-pilose on both surfaces, the margins slightly scaberulous; racemes mostly 5–7, about 1 cm. long, the rachis angled; spikelets short-pedicel, 3–3.5 mm. long, densely sericeous, the long silky hairs on the upper part widely spreading at maturity; first glume acute, about 1.5 mm. long, 3-nerved, the lateral nerves obscure; second glume acuminate, about 2.5 mm. long exclusive of the hairs, 5-nerved, the hairs on the upper half as much as 2 mm. long; sterile lemma similar to the second glume in size and indument, but terminating in a short awn equaling but rarely exceeding the apical hairs; fertile lemma mucronate, longitudinally striate, about 2 mm. long.

BRITISH NEW GUINEA: Western Division: Dagwa, Oriomo River, *Brass* 5910 (GH, US) (common on damp ridge slopes); Lake Daviumbu, Middle Fly River, *Brass* 7810 (A, US) (occasional in savannah grass cover).

Australia and New Guinea.

3. *Ichnanthus* Beauv.

Ichnanthus Beauv., Ess. Agrost. 56. pl. 12, fig. 1. 1812.

Spikelets as in *Panicum*, but more or less laterally compressed, the glumes and sterile lemma strongly nerved; first glume from half to nearly as long as the spikelet; second glume and sterile lemma equal or subequal, the lemma enclosing a palea and sometimes a staminate flower; fertile lemma dorsally compressed, chartaceous-indurate, short-stipitate and bearing on either side membranous appendages adnate to the base of the lemma or these reduced or indicated by minute excavations only (our species has only excavations). Weak-stemmed, rather broad-leaved grasses with short-pedicel spikelets in open or somewhat contracted panicles.

TYPE SPECIES: *Ichnanthus panicoides* Beauv.

1. *Ichnanthus vicinus* (F. M. Bailey) Merr., Enum. Philip. Fl. Pl. 1: 70. 1922; Ohwi, Bot. Mag. (Tokyo) 56: 5. 1942.

Panicum vicinum F. M. Bailey, Syn. Queensl. Fl. Suppl. 3: 82. 1890. Type from Australia.

Panicum nitens Merr., (Philip.) Gov. Lab. Bur. Bull. 17: 8. 1904. (non Schum. 1901). Type from the Philippines.

Culms weak, decumbent at base and rooting at the nodes, the upright branches 15–50 cm. tall; sheaths usually slightly shorter than the internodes, glabrous or more or less pubescent, villous on the margins; ligule membranous-ciliate, about 1 mm. long; blades ovate to ovate-lanceolate, 3–8 cm. long, 1–2.5 cm. wide, subglabrous to somewhat stiff-puberulent; panicles terminal and axillary, open to somewhat contracted, as much as 15 cm. long, the branches slender, compound, scabrous; spikelets glabrous, or rarely more or less pilose, 3.5–5 mm. long, more or less laterally compressed, the glumes and sterile lemma strongly nerved; glumes unequal, 5-nerved, acuminate to short-aristate, scabrous on the keels at least toward

the tips; first glume about two-thirds as long as the spikelet and separated from the second by a distinct internode; second glume and sterile lemma equal or the lemma slightly shorter; sterile lemma 5-nerved, acute to acuminate, enclosing a palea and sometimes a staminate flower; fertile lemma chartaceous-indurate, 2–2.5 mm. long, obtuse, stipitate and bearing two scars above the base.

NORTHEAST NEW GUINEA: Morobe District: Salamaua, alt. about 100 m., *Clemens* 4332 (A); alt. about 1000 m., *Clemens* 41238 (US); Boana, alt. about 100 m., *Clemens* 41808 (US). NETHERLANDS NEW GUINEA: Hollandia, alt. 50 m., *Brass* 8909 (A, US) (abundant on shaded sandy banks in a moist ravine); 4 km. southwest of Bernhard Camp, Idenburg River, alt. 850 m., *Brass* 13210 (A, US) (occasional on flooded rocky banks of river).

Southern Asia, East Indies, Philippines to New Guinea and Australia.

Very closely related to the American *Ichnananthus pallens* (Sw.) Munro ex. Benth. and perhaps should be included with that species. The spikelets of the Old World form are, in general, slightly larger and the glumes tend to be more aristate than in the American plants.

4. *Echinochloa* Beauv.

Echinochloa Beauv., Ess. Agrost. 53. *pl.* 11, *fig.* 2. 1812.

Spikelets more or less hispid, plano-convex, subsessile, in pairs or in irregular clusters along one side of the panicle branches; first glume about one-third to half the length of the spikelet, acute or mucronate; second glume and sterile lemma equal, the latter mucronate to long-awned, with a membranous palea and sometimes a staminate flower; fertile lemma indurate, slightly crested at the apex, smooth and shining, the margins in-rolled, the tip of the palea usually free. Annual or perennial grasses with usually narrow panicles of several second spikelike racemes.

TYPE SPECIES: *Echinochloa crusgalli* (L.) Beauv. (*Panicum crusgalli* L.).

KEY TO THE SPECIES

1. Ligule a dense row of hairs about 4 mm. long; sterile lemma enclosing a staminate floret; plants perennial. 3. *E. stagnina*.
 1. Ligule wanting; sterile lemma empty, but with a membranous palea; plants annual.
 2. Spikelets about 2 mm. long, the awn of the sterile lemma reduced to a short point; racemes distant, 1–2 cm. long, the upper about as long as the lower. 1. *E. colonum*.
 2. Spikelets about 3 mm. long, the awn of the sterile lemma variable, but evident; racemes more or less approximate, usually more than 2 cm. long, the upper shorter than the lower. 2. *E. crusgalli*.
 1. *Echinochloa colonum*⁷ (L.) Link, Hort. Berol. 2: 209. 1833; Hitchc., Brittonia 2: 123. 1936; C. E. Hubb. and Vaughan, Grass. Maurit. and Rodriguez 69. *fig.* 12. 1940.

Panicum colonum L., Syst. Nat. ed. 10. 2: 870. 1759; Trin., Sp. Gram. Ic. 2: *pl.* 160. 1829; K. Schum. and Lauterb., Fl. Deutsch. Schutzgeb. Südsee 178. 1901. Type from Jamaica.⁸

Oplismenus colonus (L.) H.B.K., Nov. Gen. et Sp. 1: 108. 1815.

Echinochloa crusgalli subsp. *colona* (L.) Honda, Bot. Mag. (Tokyo) 37: 122. 1923.
- ⁷ For a discussion of the proper ending of the specific epithet, see Hitchc., Contr. U. S. Nat. Herb. 17: 256. 1913.
- ⁸ See Hitchcock, Contr. U. S. Nat. Herb. 12: 119. 1908 and 22: 150. 1920.

Annual; culms glabrous, erect or decumbent, usually much branched at base, 20–80 cm. long; sheaths glabrous, shorter than the internodes, rather loose, somewhat keeled toward the summit; ligule wanting; blades rather lax, 6–15 cm. long, 3–8 mm. wide, glabrous to sparsely pubescent, the margins scabrous; panicle 5–15 cm. long, the axis and branches scabrous to puberulent; racemes simple, single or occasionally approximate, 1–2 cm. long; spikelets 2–3 mm. long, crowded, the glumes and sterile lemma glabrous to scabrous-puberulent, the nerves scabrous-hispid; first glume one-third to half as long as the spikelet, 3-nerved; second glume about equal to the sterile lemma, mucronate, 5-nerved; sterile lemma slightly exceeding the second glume, mucronate or awn-pointed, flattened on the back, enclosing a hyaline palea of equal length; fertile lemma rounded on the back, smooth and shining, obscurely 5-nerved, short-acuminate, the margins inrolled below, the apex of the palea not enclosed.

BRITISH NEW GUINEA: Central Division: Kanosia, *Carr 11022* (NY); Western Division: Strickland River, *W. Bauerlen 40* (US); Daru Island, *Brass 6044, 6300* (A, US). NORTHEAST NEW GUINEA: Morobe District: Markham Valley, Kajabit Mission, *Clemens 10476-S* (US); 4 miles south of Lange-mak Bay, *Sawyer 32, 52* (A).

Pantropic weed.

2. *Echinochloa crusgalli* (L.) Beauv., Ess. Agrost. 53, 161, 169. 1812; Chase, Jour. Arnold Arb. 24: 88. 1943.

Panicum crusgalli L., Sp. Pl. 56. 1753; Trin., Sp. Gram. Ic. 2: *pl.* 161. 1829; F. Muell., Pap. Pl. 2: 35. 1886. Type from Europe.

Annual; culms caespitose, erect or decumbent at base, 30–100 cm. tall; sheaths glabrous, rather loose, somewhat keeled, especially toward the summit; ligule wanting; blades linear, 10–40 cm. long, 5–15 mm. wide, the margins and upper surface usually scabrous; panicles 10–20 cm. long, erect or somewhat nodding, the axis scabrous and often somewhat papillose-hispid, the hairs often rather long; racemes appressed to spreading, 2–7 cm. long, simple or branching below, gradually shorter and more or less approximate upwards, the rachis scabrous and often papillose-hispid; spikelets about 3 mm. long, hispid on the nerves, the internerves scabrous to hispidulous; first glume one-third to half as long as the spikelet, acute; second glume about equaling the sterile lemma, acuminate to awn-pointed; sterile lemma mucronate-tipped or with an awn as much as 4 cm. long.

BRITISH NEW GUINEA: Western Division: Mainland opposite Daru Island, *Brass 6060* (GH, US) (common in outer shallows of a large coastal swamp); Lower Fly River, *Brass 8280* (A, US) (common on sandy foreshores); near the Dutch Boundary, *MacGregor 14* (US). NORTHEAST NEW GUINEA: Morobe District: *Clemens 4775* (A); Ogeramang, alt. about 1700 m., *Clemens 5476* (A); near Kajabit Mission, *Clemens 10650* (US). NETHERLANDS NEW GUINEA: Balim River, alt. 1600 m., *Brass 11793, 11803* (A, US) (common in ditches); Rouffaer River, alt. 65 to 175 m., *Docters van Leeuwen 9709, 10167* (NY).

Widely distributed in the warmer regions of both hemispheres.

This species is extremely variable, and numerous subspecies, varieties, and forms have been recognized. The spikelets vary slightly in size, in the length of awn on the sterile lemma, and the degree of hispidness, the hairs being sometimes tuberculate-based. The cited specimens represent both awned and nearly awnless forms, but are similar in other respects. The spikelets are less hispid than those of many European and American

plants. *Brass* 6060 was cited as *Echinochloa crus-pavonis* (H. B. K.) Schult. by Hitchcock (35, p. 123).

3. *Echinochloa stagnina* (Retz.) Beauv., Ess. Agrost. 53, 161, 171. 1812; Chase, Jour. Arnold Arb. 20: 312. 1939.

Panicum stagninum Retz., Obs. Bot. 5: 17. 1789. Type from Eastern India.

Perennial usually growing in deep water; culms rather succulent, stout, about 1 cm. in diameter, 2-? meters long, rooting from the nodes below the water level; sheaths rather loose, glabrous or sometimes ciliate on the margins; ligule a dense row of soft tawny hairs about 4 mm. long; blades 30-50 cm. long, 1-3 cm. wide, glabrous to scaberulous on both surfaces, the margins scabrous; panicle 20-50 cm. long, the axis and branches scabrous, the latter stiff-pilose at base, often somewhat branched, as much as 15 cm. long; spikelets about 4 mm. long, excluding the awns, crowded, short-pedicel, scabrous, the nerves hispid; first glume one-third to half as long as the spikelet, acute, often ciliate; second glume about equaling the sterile lemma, long-acuminate or short awn-pointed, the margins sometimes ciliate; sterile lemma flattened on the back, enclosing a palea and a staminate flower, awned from the tip, the awn 2 mm. or more long; fertile lemma 3.5-4 mm. long, plano-convex, smooth and shining, acuminate, the margins inrolled below, the tip of the palea not enclosed.

BRITISH NEW GUINEA: Western Division: Fly River, about 30 miles below Everill Junction, *Brass* 6585 (A, US). NORTHEAST NEW GUINEA: Sepik River, Nyamangai, *Herre* 319 (NY). NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, alt. 50 m., *Brass* 13785 (A, US).

India to the East Indies, Philippines and New Guinea. Also in tropical Africa. Coarse robust perennials of marshes and river banks, sometimes growing in water more than 2 meters deep. Often forming pure stands locally.

The description was drawn from New Guinea specimens which are, perhaps, more robust than usual. Small specimens may be distinguished from *E. crusgalli* by the larger spikelets and especially by the ligule; the ligule in *E. crusgalli* is wanting.

5. *Oplismenus* Beauv.

Oplismenus Beauv., Fl. Owar. 2: 14. pl. 68, fig. 1. 1809.

Orthopogon R. Br., Prodr. Fl. Nov. Holl. 1: 194. 1819.

Spikelets terete or somewhat laterally compressed, subsessile, solitary or in pairs, in two rows, crowded or approximate on one side of a narrow scabrous or hairy rachis, the back of the fertile lemma turned toward it; glumes subequal, awned, the awn of the first glume considerably longer than that of the second, often as long as or exceeding the length of the spikelet; sterile lemma empty or rarely enclosing a staminate flower, longer than the glumes and fertile floret, awnless or short-awned, the awn rarely as much as 2 mm. long; sterile palea absent or when present narrow, hyaline, ciliate at apex, fertile lemma chartaceous-indurate, pale, smooth and shining, acute, usually minutely crested, sometimes short-awned, the awn as much as 0.6 mm. long, rarely longer. Freely branching creeping annuals or perennials of shady habitats with flat lanceolate blades and inflorescences of few to several alternate spikelike racemes racemose on the main axis, the racemes sometimes very short and the spikelets crowded

and appearing fascicled, or the racemes almost totally absent and the spikelets solitary or in twos or threes along the axis.

TYPE SPECIES: *Oplismenus africanus* Beauv. = *O. hirtellus* (L.) Beauv.

KEY TO THE SPECIES

1. Racemes 1.5–6 cm. long; sterile lemma awnless or nearly so.....1. *O. compositus*.
1. Racemes 0.2–1 cm. long; sterile lemma awned, the awn 0.5–1 mm. long.....2. *O. hirtellus*.
1. *Oplismenus compositus* (L.) Beauv., Ess. Agrost. 54, 168. 1812; K. Schum., Bot. Jahrb. 9: 196. 1887; Pilger, Nat. Pflanzenfam. ed. 2. 14e: 48. fig. 25. 1940.
Panicum compositum L., Sp. Pl. 57. 1753; F. Muell., Pap. Pl. 1: 31, 74. 1876.
Type from Ceylon.

Culms up to 1 meter long, decumbent at base and rooting from the lower nodes; sheaths shorter than the internodes, glabrous to rather densely papillose-pilose, the margins ciliate; ligule hyaline, truncate, ciliate above; blades lanceolate to ovate-lanceolate, 5–15 cm. long, 1–2 cm. wide, rarely wider, subglabrous to pilose, usually more densely hairy below, the margins often undulate; racemes usually densely flowered, 1.5–6 cm. long or longer; spikelets glabrous to pilose, terete or nearly so; glumes subequal, 1.5–3 mm. long excluding the awns; awn of the first glume 2–8 mm. long, that of the second 0.3–1.5 mm.; sterile lemma exceeding the glumes, 3–4 mm. long, awnless or nearly so, usually enclosing a narrow hyaline palea about equal to the lemma, and rarely also a staminate flower; fertile lemma smooth and shining, 2.5–3 mm. long, the apex with a minute laterally compressed crest which may appear as a minute mucro in dorsal or ventral view especially when immature.

BRITISH NEW GUINEA: Northern Division: Soputa, *DeKalb Russell Jr.* in 1943 (US). NORTHEAST NEW GUINEA: Morobe District: Markham Valley, Kajabit, *Clemens 10568* (US); Finschhafen, *Weinland 279* (US); without precise locality, *Rodatz & Klink 69* (US). NEW BRITAIN: Talasea, near Bitokara Mission, *Burcham 137* (US).

Widely distributed in the tropics of the Old World.

2. *Oplismenus hirtellus* (L.) Beauv., Ess. Agrost. 54, 168. 1812; Stapf in Prain, Fl. Trop. Afr. 9: 631. 1920; Hitchc., Proc. Linn. Soc. N. S. Wales 54: 146. 1929.
Panicum hirtellum L., Syst. Nat. ed. 10. 2: 870. 1759; Sp. Pl. ed. 2. 83. 1763. Type from Jamaica.
- Oplismenus africanus* Beauv., Fl. Owar. 2: 15. pl. 68, fig. 1. 1809. Type from West Africa.
- Oplismenus aristulatus* Burcham, Contr. U. S. Nat. Herb. 30: 419. fig. 1. 1948.
Type from New Britain.

Slender creeping branching perennial, the ascending flowering culms 20–40 cm. tall; sheaths mostly shorter than the internodes, glabrous to papillose-pilose, the margins and collar densely pubescent-ciliate; ligule membranous, truncate, erose, ciliate, the hairs often equaling the membrane; blades lanceolate, narrowed at the base, 3–10 cm. long, 5–10 (rarely to 16) mm. wide, the margins usually undulate, glabrous or scabrous to variously pubescent, usually more densely so on the lower surface, the hairs sometimes papillose-based; racemes distant, 2–10 mm. long (in our specimens), densely flowered, the spikelets often appearing fascicled, the narrow angled rachis scabrous to long stiff pilose; spikelets terete or somewhat laterally compressed, 3–4.5 mm. long excluding the

awns, sparsely to densely pubescent, the hairs sometimes papillose-based; glumes subequal, 2–3 mm. long; first glume awned from the tip, the awn 3–8 mm. long; second glume awned from the apex or slightly below it, the awn 0.5–3.5 mm. long, slightly more slender than that of the first glume; sterile lemma slightly exceeding the glumes, pubescent on the upper half especially toward the margins, the apex bearing a short awn 0.5–1 mm. long; sterile palea, when present, narrow, hyaline, 1.5–3 mm. long, the apex ciliate; fertile lemma pale, 2–3 mm. long, smooth and shining, faintly nerved, the apex with a minute laterally compressed crest which is sometimes prolonged into a mucro as much as 0.6 mm. long.

BRITISH NEW GUINEA: Central Division: Rona, Laloki River, alt. 450 m., *Brass* 3647 (A, US) (common rain forest floor plant); Eastern Division: Mori River, *Brass* 1534 (GH, US) (on forest paths); Western Division: Lake Daviumbu, Middle Fly River, *Brass* 7483 (A, US) (abundant in light forest shade). NORTHEAST NEW GUINEA: Morobe District: Sarawaket, *Clemens* 5756 (A); Dreger Harbor, near Finschhafen, *Reeder* 868 (A, US) (in shade of bamboos). NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, alt. 1600 m., *Brass* 12364 (A, US) (rain-forest, one small clump in the stony bed of a stream); 4 km. southwest of Bernhard Camp, Idenburg River, alt. 850 m., *Brass* 13719 (A, US) (on open sandy banks of a rain-forest stream); Waren, *Kanehira and Hatusima* 13160 (A). NEW BRITAIN: Talasea, Bitokara Mission, *Burcham* 138 (US) (under rain-forest, along trail).

Widely distributed in the tropics of both hemispheres.

A wide-ranging polymorphic species which is difficult to characterize. Perhaps the best character for recognizing this species is the short-awned sterile lemma of the spikelets which are arranged in short racemes racemose along a main axis, the rachis varying from 2 mm. to a centimeter or more in length, but rather uniform on one plant. Specimens with rather long racemes may be distinguished from *Oplismenus compositus* with a fair degree of accuracy, since that species has an awnless sterile lemma. In other respects the spikelets are very similar. Some of the New Guinea plants look very much like *O. setarius* (Lam.) Roem. and Schult. and have been so reported by the early German workers. Typical *O. setarius* from the New World, however, usually has smaller leaves and slightly smaller spikelets, but the reasons for considering it as distinct from *O. hirtellus* are not altogether convincing, as there seem to be numerous intergrades. Stapf (in Prain, Fl. Trop. Afr. 9: 632. 1920) does not consider it distinct. Some of the cited specimens have been referred to *O. undulatifolius* (Ard.) Roem. and Schult. (see Hitchc., Brittonia 2: 123. 1936) and to *O. undulatifolius* var. *imbecillis* (R. Br.) Hack. (see Ohwi, Bot. Mag. (Tokyo) 56: 7. 1942). Typical *O. undulatifolius*, however, has characteristically spreading-pilose sheaths, and the inflorescence consists of rather long racemes below, which become progressively shorter upward until the spikelets are borne singly or in only twos or threes on the upper part of the axis. *Oplismenus undulatifolius* var. *imbecillis* (based on *Orthopogon imbecillis* R. Br. from Australia) has very much reduced racemes, the spikelets being borne singly or in small groups on the main axis, the sterile lemma is awnless, and the awn of the second glume is much reduced.

One of the cited specimens (*Burcham 138*) has been designated the type of a new species (*Oplismenus aristulatus* Burcham), based primarily on the mucronate character of the fertile lemma. The spikelets are densely pubescent, borne in short racemes, the rachis of which is 2-6 mm. long, and the blades are up to 10 cm. long and 15 mm. wide. The validity of this species seems doubtful, however, when it is seen that the fertile lemmas are crested throughout the genus and the crest may extend as a mucro or even a short awn in vastly different appearing plants. Some Philippine specimens (see *Philip. Bur. Sci. No. 30286*, collected by M. Ramos in 1917, and *Elmer 17105*) have blades only 2-5 cm. long and 3-7 mm. wide and nearly glabrous spikelets, but the fertile lemma has an awn fully as long as the Burcham specimen. On the other hand a Japanese specimen (Nat. Herb. No. 1130009) which resembles in many respects the figure accompanying the original description of *O. undulatifolius*, has blades as much as 8 cm. long and 2 cm. wide, and lower racemes up to 10 mm. long, but the fertile lemma bears an awn about 0.5 mm. long. A specimen from Formosa (*Beattie and Kurihara 10393*) has the long racemes (up to 8 cm. long) of *O. compositus* but the fertile lemma bears an awn 0.2-1 mm. long. Other cases could be cited. Another interesting specimen (*Mills-paugh 2679*) from Japan may help to evaluate the importance of the awned fertile lemma as a specific character. In this specimen the same raceme was found to have some of the lemmas completely awnless, while others had awns fully 1 mm. long. In view of the above evidence, it seems undesirable to consider the mucronate to short-awned fertile lemma as at all unique, but rather as a potentiality which may appear anywhere in the genus.

6. *Sacciolepis* Nash

Sacciolepis Nash in Britton, Man. 89. 1901.

Spikelets oblong-conic, more or less oblique in profile, somewhat laterally compressed; first glume much shorter than the spikelet; second glume more or less inflated-saccate or gibbous on the back, strongly many-nerved; sterile lemma equaling the second glume but fewer-nerved and with a reduced hyaline palea; fertile lemma dorsally compressed, stipitate, elliptic, chartaceous-indurate, the margins inrolled. Plants of damp habitats with dense contracted, spikelike panicles.

TYPE SPECIES: *Sacciolepis striata* (L.) Nash (*Holcus striatus* L., *Panicum gibbum* Ell.).

KEY TO THE SPECIES

1. Spikelets 1.5-2 mm. long, only slightly gibbous; fertile floret nearly as long as the spikelet.....1. *S. myosuroides*.
1. Spikelets 2-3.5 mm. long, strongly gibbous; fertile floret only about half as long as the spikelet.....2. *S. indica*.
1. *Sacciolepis myosuroides* (R. Br.) Chase ex A. Camus in Lecomte, Fl. Gén. Indo-Chine 460. 1922; Blatter and McCann, Imp. Council Agric. Res. Sci. Monogr. 5: pl. 107. 1935; Hitchc., Brittonia 2: 123. 1936.
Panicum myosuroides R. Br., Prodr. Fl. Nov. Holl. 1: 189. 1810. Type from Australia.

Panicum phleiforme Presl, Rel. Haenk. 1: 310. 1830; Hack., Bot. Jahrb. 13: 258. 1890; Scribn., Missouri Bot. Gard. Rep. 10: 47. *pl.* 21. 1899. Type from the Philippines.

Hymenachne myosuroides (R. Br.) Balansa, Jour. de Bot. 4: 143. 1890.

Culms erect or somewhat decumbent and rooting at the lower nodes, the upright or ascending portion 15–110 cm. tall; sheaths glabrous, mostly shorter than the internodes, subcompressed with scarious margins; ligule membranous, ciliate, about 1 mm. long; blades flat to subinvolute, as much as 20 cm. long, 2–4 mm. wide, glabrous or somewhat scabrous on the margins; panicle densely flowered, much contracted, spike-like, 5–20 (rarely 30) cm. long; spikelets obtuse to subacute, glabrous or sparsely pubescent toward the tip, 1.5–2 mm. long; first glume about one-third to half as long as the sterile lemma, only very slightly gibbous on the back, 7–9-nerved; sterile lemma 7-nerved, similar to the second glume but with a reduced hyaline palea; fertile floret nearly as long as the spikelet.

BRITISH NEW GUINEA: Western Division: Dagwa, Oriomo River, alt. 45 m., *Brass* 6029 (A, US) (scattered in shallows of a lagoon on savannah); Middle Fly River, Lake Daviumbu, *Brass* 7854 (A, US) (growing in shallow water on wet grass plains). NORTHEAST NEW GUINEA: Morobe District: Boana, alt. 800–1300 m., *Clemens* 41356a (US).

Tropical Africa and Asia to Australia and Polynesia.

Related to *Sacciolepis indica*, but may be distinguished by its smaller obtuse to subacute spikelets with the second glume only slightly gibbous on the back. The spikelets of *S. indica* are acuminate and strongly gibbous.

2. *Sacciolepis indica* (L.) Chase, Proc. Biol. Soc. Wash. 21: 8. 1908; Hitchc., Brittonia 2: 122. 1936.

Aira spicata L., Sp. Pl. 63. 1753 (non op. cit. 64); *Aira indica* L., Sp. Pl. (in errata). 1753. Type from India.

Panicum indicum L., Mant. 2: 184. 1771; Trin., Sp. Gram. Ic. 2: *pl.* 197. 1829; Pilger, Bot. Jahrb. 52: 171. 1914. Type from India.

Panicum contractum Wight and Arn., Linnaea 10: Litt. 117. 1836. Type from India.

Neurachne Peekelii Lauterb., Bot. Jahrb. 45: 356. 1911. Type from New Ireland.⁹

Sacciolepis contracta (Wight and Arn.) Hitchc., Mem. Bishop Mus. 8: 199. *fig.* 90. 1922; Chase, Jour. Arnold Arb. 24: 87. 1943.

Culms erect or creeping, often densely tufted, simple or branching, 10–150 (commonly 30–60) cm. tall; sheaths shorter than the internodes, somewhat keeled toward the summit, glabrous to more or less densely papillose-pubescent; ligule membranous, about 0.5 mm. long; blades flat to loosely involute, as much as 25 cm. long, 2–5 (rarely up to 8) mm. wide, glabrous to more or less pubescent; panicle long-exserted, 1–15 cm. long, the axis and terete discoid-tipped pedicels glabrous; spikelets 2–3.5 mm. long, glabrous to rather densely papillose-hispid (usually with at least a few hairs near the tip); first glume one-third to two-thirds as long as the spikelet, 3–7-nerved, the margins scarious; second glume strongly gibbous on the back, about 9–11-nerved; sterile lemma equal to the second glume and similar to it but not gibbous and with a poorly developed hyaline palea; fertile lemma about half as long as the spikelet.

⁹ The type was not seen, but Pilger (Bot. Jahrb. 52: 171. 1914) says that it represents *Panicum indicum* L. [*Sacciolepis indica* (L.) Chase].

BRITISH NEW GUINEA: Central Division: Urunu, Vanapa Valley, alt. 1900 m., *Brass* 4789 (GH, US) (a common erect grass on open grassland); Mafulu, alt. 1250 m., *Brass* 5483 (GH, US) (rare on roadsides and in grasslands); Western Division: Wuroi, Oriomo River, *Brass* 5744 (US), 5827 (GH, US) (rare on damp soil on savannah); Palmer River, 1 mile above junction Black River, alt. about 100 m., *Brass* 6961 (A, US) (on gravel bar); Lake Daviumbu, Middle Fly River, *Brass* 7519 (A, US) (tufted on patches of hard pan in savannahs), *Brass* 7880 (A, US) (occasional on hummocks of wet grass plains); Gaima, Lower Fly River, *Brass* 8351 (A, US) (sporadic in open savannah forest); Tarara, Wassi Kussa River, *Brass* 8713, 8776 (A, US) (savannah forest ridges); Northern Division: About 3 miles south of Dobodura, *Reeder* 823, 825, 847 (A, US) (low, wet ground). NORTHEAST NEW GUINEA: Morobe District: Yunzaing, alt. about 1000 m., *Clemens* 4053 (US); Sattelberg, alt. 100 m., *Clemens* 4315 (A); Wantoat, elev. 1000-2000 m., *Clemens* 10955 bis (US); alt. 80-1200 m., *Clemens* 41356a (US); four miles south of Langemak Bay (near Finschhafen), *Sawyer* 143 (A). NETHERLANDS NEW GUINEA: 9 km. northeast of Lake Habbema, alt. 2800 m., *Brass* 10736 (A, US) (several suberect tufts about 80 cm. tall on a native clearing in the forest); 18 km. northeast of Lake Habbema, Bele River, alt. 2200 m., *Brass* 11524 (A, US) (plentiful on old garden lands); Balim River, alt. 1600 m., *Brass* 11824 (A, US) (plentiful on sandy, long deforested slopes); Nassau Region, Explorat Biv., alt. 1200 m., *Docters van Leeuwen* 10809 (GH); Utakwa Expedition to Mt. Carstensz, Camp VI, alt. about 1000 m., *Kloss* in 1913 (US); Angi, Arfak Mountains, alt. 1900 m., *Kanehira & Hatusima* 13826 (A).

The type specimen in the Linnaean Herbarium is a delicate creeping or spreading plant with many short spikes (about 1 cm. long) of only a few spikelets.¹⁰ Among the specimens cited above, *Brass* 5824 is most nearly like the type. The species is an extremely variable one, however, and all variations may be seen from small glabrous plants (only about 10 cm. tall) to tall pubescent plants (150 cm. or more in height). The spikelets themselves vary from glabrous to densely papillose-pubescent, but all show the characteristic form and structure. There seems to be no correlation between the pubescence on the spikelets and that on the rest of the plant. While *Reeder* 825 and 847 (the tallest and most hairy of the specimens cited) appear at first to be distinct, critical study shows that there is no reliable character by which they may be separated. In view of the numerous intergrades between these tall hairy plants and the glabrous ones, it seems advisable to consider all the above-cited specimens as conspecific and members of an extremely polymorphic species (*S. indica*) in which even varieties can be separated in only the most arbitrary manner.

7. *Pseudechinolaena* (Hook. f.) Stapf

Pseudechinolaena (Hook. f.) Stapf in Prain, Fl. Trop. Afr. 9: 494. 1919.

Panicum sect. *Pseudechinolaena* Hook. f., Fl. Brit. Ind. 7: 28, 58. 1896.

Spikelets obliquely ovoid, laterally compressed and usually conspicuously gaping, in pairs or more often solitary on a narrow rachis of spike-like, racemosely arranged racemes, the back of the fertile lemma turned away from the rachis; glumes about equal or the first somewhat shorter;

¹⁰ From data recorded by A. S. Hitchcock after examination of the type in 1907. Prof. Hitchcock's notebooks are preserved in the Hitchcock-Chase Agrostological Library at the Smithsonian Institution.

first glume 3-nerved, flat, smooth or scabrous along the midnerve; second glume 7-nerved, gibbous and more or less uncinately spiny at maturity; sterile lemma as long as the spikelet, obscurely nerved, smooth or minutely tuberculate under a lens, enclosing a palea and sometimes a staminate flower; fertile lemma somewhat laterally compressed, indurate, smooth and shining, the margins clasping the palea but not inrolled. Weak-stemmed annuals with broad thin leaves and short few-flowered panicles.

TYPE AND ONLY SPECIES: *Pseudechinolaena polystachya* (H.B.K.) Stapf (*Echino-laena polystachya* H.B.K.).

1. *Pseudechinolaena polystachya* (H.B.K.) Stapf in Prain, Fl. Trop. Afr. 9: 495. 1919, Hook. Ic. 31: pl. 3094. 1922.

Echinolaena polystachya H.B.K., Nov. Gen. et Sp. 1: 119. 1815. Type from Colombia.

Panicum uncinatum Raddi, Agrost. Bras. 41. 1823. Type from Brazil.

Culms creeping and rooting at base, 40–60 cm. long, prominently striate and sparsely pubescent; sheaths shorter than the internodes, more or less pubescent, ciliate along the margins; ligule membranous, 1–2 mm. long, often ciliate; blades thin, ovate-lanceolate, 3–6 cm. long, 1–1.5 cm. wide, sparsely appressed-pubescent, the hairs stiff; racemes few to several, erect or ascending, loosely flowered, racemose along a main axis, the rachis narrow, scabrous; spikelets about 5 mm. long.

NORTHEAST NEW GUINEA: Morobe District: Sattelberg, alt. 1000 m., Clemens 662 (A, US); near Kajabit Mission, alt. about 300 m., Clemens 40800 (US); Boana, alt. about 800 m., Clemens 41591 (US).

Shady habitats in the tropics of both hemispheres.

8. *Cyrtococcum* Stapf

Cyrtococcum Stapf in Prain, Fl. Trop. Afr. 9: 745. 1920.

Spikelets laterally compressed, obliquely obovate, in open or somewhat contracted panicles; glumes unequal, membranous, 3-nerved, the first smaller, the second cymbiform and nearly as long as the spikelet; sterile lemma 5-nerved, equaling the spikelet and with a reduced palea (this sometimes wanting); fertile lemma indurate, strongly gibbous on the back and with a small crest near the tip, the margins inrolled and clasping a narrow, convex palea. Annual or perennial grasses of shady habitats, with thin, lanceolate blades and creeping culms.

TYPE SPECIES: *Cyrtococcum setigerum* (Beauv.) Stapf (*Panicum setigerum* Beauv.).

KEY TO THE SPECIES

1. Panicles contracted, the branches rather stout, angled.
 2. Spikelets glabrous; plants 20–40 cm. tall.....1. *C. oxyphyllum*.
 2. Spikelets hispid; plants low, 6–15 cm. tall.....2. *C. trigonum*.
1. Panicles diffuse, the branches capillary, terete.....3. *C. patens*.
1. *Cyrtococcum oxyphyllum* (Hochst. ex Steud.) Stapf, Hook. Ic. 31: sub pl. 3096. 1922.

Panicum oxyphyllum Hochst. ex Steud., Syn. Pl. Glum. 1: 65. 1854; Hitchc., Brittonia 2: 122. 1936. Type from India.

Panicum pilipes Nees and Arn. ex Buse in Miq., Pl. Jungh. 3: 376. 1854; K. Schum., Notizbl. Bot. Gart. Berlin 2: 93. 1898. Type from Java.

Panicum hermaphroditum Steud., Syn. Pl. Glum. 1: 67. 1854; Hack., Bot. Jahrb. 13: 259. 1890. Type from the Philippines.

Cyrtococcum pilipes (Nees and Arn. ex Buse) A. Camus, Bull. Mus. Hist. Nat. (Paris) 27: 118. 1921; Blatter and McCann, Imp. Council Agric. Res. Sci. Monogr. 5: pl. 110. 1935.

Culms glabrous, creeping, often somewhat flattened, the ascending flowering branches 20–40 cm. tall; sheaths shorter than the internodes, pubescent, ciliate on the margins, keeled, especially toward the summit; ligule membranous, about 1 mm. long; blades 3–10 cm. long, 5–10 mm. wide, pubescent, more densely so beneath, the upper surface often almost glabrous; panicle contracted, densely flowered, 4–10 cm. long, shortly exserted, the branches rather stout; spikelets about 1.8 mm. long, glabrous, the base subtended by a few fine hairs; fertile lemma short-stalked, strongly gibbous on the back, smooth and shining, but under a lens minutely longitudinally striate.

BRITISH NEW GUINEA: Eastern Division: Aisa River, *Brass* 1423 (GH, US) (on shady forest paths); Central Division: Dieni, Ononge Road, alt. 500 m., *Brass* 3820 (GH, US) (common on roadside); Kabuna, alt. 100 m., *Brass* 5594 (GH, US) (plentiful on pathways in forest); Kanosia, *Carr* 11171 (US) (clearing in forest); *Carr* 11786 (US) (swampy land under *Hevea*); Brown River, *Carr* 12941 (US) (river bank); Northern Division: About 2 miles north of Big Embi Lake, *Reeder* 820 (A, US) (in partial shade on creek bank); Without precise locality: *Chalmers* 59 (US). NORTHEAST NEW GUINEA: Morobe District: Finschhafen, *Weinland* 278 (US). NEW BRITAIN: Near Bitokara Mission, Talasso, *Burcham* 139 (US) (under rain-forest). SOLOMON ISLANDS: Bougainville: *Kajewski* 2139 (GH); San Cristoval: *Brass* 2732, 2857A (GH). Indo-Malayan region to New Guinea.

2. *Cyrtococcum trigonum* (Retz.) A. Camus, Bull. Mus. Hist. Nat. (Paris) 27: 118. 1921.

Panicum trigonum Retz., Obs. Bot. 3: 9. 1783; Hack., Bot. Jahrb. 13: 259. 1890. Type probably from India.

Culms slender, glabrous, creeping, the ascending flowering branches 5–15 cm. long; sheaths equaling or longer than the internodes (sometimes slightly shorter), glabrous except for the long-ciliate margins; ligule membranous, decurrent, 0.3–0.5 mm. long; blades 1–4.5 cm. (mostly 2–3 cm.) long, 2–5 mm. wide, subglabrous to sparingly papillose-pubescent, the hairs more numerous on the upper surface; panicle very contracted, 1–3 cm. long, the rachis and branches rather stout and angled, the lowermost branches not more than 1 cm. long; spikelets 1.6–2 mm. long, hispid or tuberculate-hispid, the first glume often nearly glabrous, the hairs confined to the second glume and sterile lemma.

BRITISH NEW GUINEA: Central Division: Koitaki, *Carr* 11964 (US). India to the Philippines, New Guinea and Samoa. Introduced into the West Indies.

3. *Cyrtococcum patens* (L.) A. Camus, Bull. Mus. Hist. Nat. (Paris) 27: 118. 1921; Ohwi, Bot. Mag. (Tokyo) 56: 6. 1942.

Panicum patens L., Sp. Pl. 58. 1753; K. Schum. and Lauterb., Fl. Deutsch. Schutzgeb. Südsee 178. 1901. Type from India.

Panicum radicans Retz., Obs. Bot. 4: 18. 1786. Type from China.

Panicum accrescens Trin., Sp. Gram. Ic. 1: pl. 88. 1827. Type from India.

Panicum carinatum Presl, Rel. Haenk. 1: 309. 1830; Guppy, Solomon Islands 304. 1887; K. Schum., Notizbl. Bot. Gart. Berlin 1: 206. 1896; Scribn., Missouri Bot. Gard. Rep. 10: 46. pl. 17. 1899. Type from the Philippines.

Paspalum carinatum (Presl) K. Schum. and Hollr., Fl. Kais. Wilhelmsland 21. 1889. Error for *Panicum carinatum* Presl.

Culms glabrous, slender, creeping, the ascending flowering branches as much as 60 cm. tall; sheaths mostly shorter than the internodes, papillose-pilose, the margins ciliate; ligule membranous, about 1 mm. long; blades subglabrous to more or less densely appressed-pubescent, often papillose-pilose toward the base, 5–15 cm. long, 6–15 mm. wide; panicle diffuse, as much as 30 cm. long, the capillary branches and branchlets smooth, spikelet-bearing toward their ends; spikelets about 1.5 mm. long, purplish, glabrous or minutely hispidulous, especially toward the tips of the glumes and sterile lemma; fertile lemma indurate, minutely longitudinally striate.

BRITISH NEW GUINEA: Central Division: Kubuna alt. 100 m., *Brass* 5617 (A, US) (plentiful in native gardens); Western Division: Daru Island, *Brass* 6295 (A, US) (massed under shade of mango trees in native gardens); Middle Fly River, Lake Daviumbu, *Brass* 7773, 7889 (A, US) (common weed in rain-forest clearings and in native villages); Northern Division: About 9 miles northwest of Oro Bay, *Reeder* 824 (A, US) (in sandy soil of recent borrow pit); Good-enough Island: Two miles west of Haiwali Village, *Burcham* 135 (US) (scanty soil among boulders in dense secondary growth near native village). NORTHEAST NEW GUINEA: Morobe District: Wantoat, *Clemens* 11272 (US); *Weinland* 276 (US). SOLOMON ISLANDS: Bougainville: *Kajewski* 2253 (GH).

Indo-Malayan region to New Guinea and Polynesia.

3a. *Cyrtococcum patens* (L.) A. Camus var. *Warburgii* (Mez) comb. nov.

Panicum Warburgii Mez in Perkins, *Fragm. Fl. Philip.* 143. 1904. Type from the Philippines.

Panicum patens var. *parvulum* Warb. ex Mez, *loc. cit.* (as synonym of *P. Warburgii*).

Panicum patens L. var. *Warburgii* (Mez) Hack. ex Merr., *Philip. Jour. Sci.* 1: Suppl. 362. 1906 (as synonym of *P. Warburgii*).

Cyrtococcum Warburgii (Mez) Stapf, *Hook. Ic.* 31: sub *pl.* 3096. 1922.

Much smaller than the species; blades 1–5 cm. long, 2–4 mm. wide; panicle 5–8 cm. long, often reduced to only a few branches; spikelets borne on terete capillary branches seemingly identical with those of *C. patens*. Perhaps it represents only a depauperate form of that species.

BRITISH NEW GUINEA: Central Division: Lolorua, *Carr* 11503 (NY) (swampy land under *Hevea*).

Philippines and New Guinea.

9. *Cleistochloa* C. E. Hubb.

Cleistochloa C. E. Hubb., *Hook. Ic.* 33: *pl.* 3209. 1933.

Spikelets dorsally compressed, dimorphic, the back of the fertile lemma turned away from the axis; cleistogamous spikelets solitary, abundant in the axils of the sheaths, freely disarticulating from the pedicels when mature; chasmogamous spikelets borne in short, terminal, spike-like racemes; glumes unequal, the first small, hyaline, nerveless, the second nearly as long as the spikelet; sterile lemma about equaling the second glume and similar to it in the chasmogamous spikelets—in the cleistogamous spikelets much thickened and indurate on the back and with two prominent grooves, beaked, and as long as the fertile lemma which it nearly encloses; fertile lemma punctate-rugose in both kinds of spikelets, the margins thin, not inrolled. Perennial branching grasses with slender rigid culms, rigid blades, ciliate ligules, and short spike-like racemes.

Cleistogamous spikelets seem to be produced continually throughout the year while the terminal racemes appear only at certain seasons.

TYPE SPECIES: *Cleistochloa subjuncea* (Domin) C. E. Hubb. (*Panicum subjunceum* Domin, non Ekman).

1. *Cleistochloa Sclerachne* (F. M. Bailey) C. E. Hubb., Hook. Ic. 33: sub *pl.* 3209. 1933.

Chionachne Sclerachne F. M. Bailey, Queensl. Dept. Agr. Bull. 7 (Bot. Bull. 2): 21. 1891. Type from Australia.

Polytoca Sclerachne (F. M. Bailey) F. M. Bailey, Queensl. Fl. 6: 1849. 1902.

Perennial; culms tufted from a woody base, glabrous, rigid, branching, some of them weak and straggling, as much as 130 cm. long; sheaths much shorter than the internodes, glabrous or sparsely papillose-pilose, the hairs when present as much as 5 mm. long, ciliate on the margins, the hairs often much longer toward the ligule; ligule a row of stiff hairs about 0.5 mm. long; blades freely disarticulating from the sheaths, rigid, flat to sub-involute, 3–7 cm. long, 1.5–3.5 mm. wide, glabrous or minutely pubescent, often with a few long hairs near the base, the margins scabrous; chasmogamous spikelets about 5 mm. long, glabrous except for short cilia at the tip of the second glume and lemmas; first glume bifid, nerveless, about 0.5 mm. long; second glume slightly shorter than the spikelet, 5-nerved, the apex obtuse; sterile lemma as long as the spikelet, 7–9-nerved, obtuse; fertile lemma punctate-rugose; cleistogamous spikelets 5.5–8 mm. long, glabrous and shining except for a few minute cilia at the tip; first glume nerveless, reduced to an obscure rim at the base of the spikelet; second glume about one-sixth shorter than the spikelet, obtuse to apiculate, 5–7-nerved; sterile lemma indurate, prominently beaked, nearly as long as the fertile lemma which it almost completely encloses; fertile lemma punctate-rugose, chartaceous-indurate, the long beak usually extending slightly as a hard point through the overlapping margins of the tip of the sterile lemma.

BRITISH NEW GUINEA: Western Division: Tarara, Wassi Kussa River, Brass 8735 (A, US) (on raw clay soils).

Australia and New Guinea.

Closely related to *Cleistochloa subjuncea* (Domin) C. E. Hubb., but that species has truncate or emarginate second glume and sterile lemma in the chasmogamous spikelets and truncate second glume in the cleistogamous spikelets. The cited specimen has only one chasmogamous spikelet which is glabrous rather than pubescent. In all other respects it agrees well with the emended description by Hubbard (loc. cit.) and compares favorably with a topotype in the U. S. National Herbarium. This specimen was referred to *C. subjuncea* by Chase (17, p. 312).

10. *Alloteropsis* Presl

Alloteropsis Presl, Rel. Haenk. 1: 343. *pl.* 47. 1830.

Coridochloa Nees, Edinb. New Phil. Jour. 15: 381. 1833.

Spikelets ovate-lanceolate, dorsally compressed, in pairs or clusters along the narrow trigonous rachis, the back of the fertile lemma turned toward it; glumes membranous, unequal, the first smaller, 3-nerved and often with a short awn or mucro, the second equaling the spikelet, 5-nerved, the outer nerves submarginal and densely ciliate; sterile lemma similar but usually of a firmer texture than the second glume, the margins glabrous or

with a few weak hairs, enclosing a short cleft palea and sometimes a staminate flower; fertile lemma chartaceous-indurate, smooth, with an awn as much as 3 mm. long, the margins thin and delicately ciliate, the palea of a similar texture. Perennials (ours) with densely tufted culms and few to several subdigitate racemes.

TYPE SPECIES: *Alloteropsis semialata* (R. Br.) Hitchc. (*Panicum semialatum* R. Br.).

1. *Alloteropsis semialata* (R. Br.) Hitchc., Contr. U. S. Nat. Herb. 12: 210. 1909; Brittonia 2: 124. 1936.

Panicum semialatum R. Br., Prodr. Fl. Nov. Holl. 1: 192. 1810; F. Muell., Pap. Pl. 2: 19. 1885; Maiden, Grass. N. S. Wales 33. pl. 1898. Type from Australia.

Urochloa semialata (R. Br.) Kunth, Rev. Gram. 1: 31. 1829.

Alloteropsis distachya Presl, Rel. Haenk. 1: 344. pl. 47. 1830; Scribn., Missouri Bot. Gard. Rep. 10: 37. pl. 23. 1899. Type probably from Luzon, Philippines, but the locality incorrectly cited by Presl as California.¹¹

Coridochloa semialata (R. Br.) Nees, Jour. Bot. Kew Misc. 2: 97. 1850.

Axonopus semialatus (R. Br.) Hook. f., Fl. Brit. Ind. 7: 64. 1896.

Perennial; culms densely caespitose, slender, erect, 30–100 cm. tall, glabrous, or more or less pubescent below the inflorescence, the nodes somewhat bearded; basal sheaths velvety-villous, forming a compact tufted base to the culm, upper sheaths glabrous to more or less pilose; ligule membranous, erose, about 0.3 mm. long; blades linear, 10–30 cm. long, 3–7 mm. wide, flat, involute in drying, glabrous to papillose-pilose, especially below; racemes 2–4, 3–15 cm. long, subdigitate, the rachis slender, angled, villous; spikelets ovate-lanceolate, 5–6 mm. long; first glume about half as long as the spikelet, 3-nerved, mucronate or awn-tipped; second glume pointed or awn-tipped, densely ciliate, the hairs appressed at first, finally widely spreading; sterile lemma similar to the second glume but slightly more firm, awnless, often sparsely ciliate on the margins, enclosing a short hyaline cleft palea and often a staminate flower; fertile lemma chartaceous-indurate, bearing an awn as much as 3 mm. long, the margins ciliate.

BRITISH NEW GUINEA: Central Division: Kanosia, Carr 11054, 11546 (NY) (on open savannah land); Port Moresby to Kalo, MacGregor 37 (US); Northern Division: About 9 miles northwest of Oro Bay, Reeder 802 (A, US) (in rich black soil of grassland); Western Division: Wuroi, Oriomo River, alt. 10–30 m., Brass 5745 (US) (on savannah ridges); Daru Island, Brass 6343 (A, US) (on hard-packed soil of roadways); Lake Daviumbu, Middle Fly River, Brass 7924 (A, US) (occasional on savannah slopes); Tarara, Wassi Kussa River, Brass 8409 (A, US) (common on ridges in savannah forests); Goodenough Island: Malauna Creek, Burcham 131 (US) (occasional along creek bed and banks). NORTHEAST NEW GUINEA: Morobe District: Wau, Clemens 10459bis (US).

Tropical regions of the Eastern Hemisphere.

11. *Hymenachne* Beauv.

Hymenachne Beauv., Ess. Agrost. 48. pl. 10, fig. 8. 1812.

Spikelets acuminate, short-pedicel in dense spikelike or interrupted panicles; first glume acute to acuminate, 3–5-nerved, one-third to half as long as the spikelet, separated from the second glume by a distinct inter-

¹¹ See Hitchcock, Contr. U. S. Nat. Herb. 12: 210. 1909.

node; second glume and sterile lemma 5-nerved, acuminate, the lemma longer and often with an awn-like tip; fertile lemma pale, membranous, the margins not inrolled, the tip of the palea free. Coarse aquatic perennials with broad, firm, cordate-clasping blades and long contracted or spikelike panicles with densely flowered branches.

TYPE SPECIES: *Hymenachne amplexicaulis* (Rudge) Nees (*Panicum amplexicaule* Rudge).

1. *Hymenachne amplexicaulis* (Rudge) Nees, Agrost. Bras. 276. 1829; Pilger, Nat. Pflanzenfam. ed. 2. 14e: 49. fig. 26. 1940; Chase, Jour. Arnold Arb. 20: 312. 1939.

Panicum amplexicaule Rudge, Pl. Guiana 1: 21. pl. 27. 1805; Trin., Sp. Gram. Ic. 2: pl. 205. 1829. Type from British Guiana.

Coarse aquatic perennial; culms succulent, rather stout, usually 1–2 meters or more long, often decumbent below and rooting at the nodes; sheaths rather loose, often overlapping, glabrous or ciliate on the margins; ligule membranous, 1–2 mm. long; blades flat, rather firm, about 15–35 cm. long, 1.5–3 cm. wide, acuminate, gradually narrowed from the cordate-clasping base, the margins scabrous, more or less papillose-hispid-ciliate at the base; panicles 15–30 cm. long, spikelike, the lower branches often distant; spikelets 3.5–5 mm. long, acuminate, the second glume and sterile lemma scabrous on the nerves, the lemma often awn-pointed; fertile lemma thin-membranous, about 3 mm. long.

BRITISH NEW GUINEA: Western Division: Lake Daviumbu, Middle Fly River, Brass 7613 (A, US) (sporadic in *Oryza* and *Leersia* stands of swamp margins).

NETHERLANDS NEW GUINEA: Bruine River, alt. about 100 m., *Docters van Leeuwen* 11149 (GH).

Tropical and subtropical regions of both hemispheres.

12. *Digitaria* Heist. ex Haller¹²

Digitaria Heist. ex Haller, Hist. Stirp. Helvet. 2: 244. 1768; Scop., Fl. Garn. ed. 2. 1: 52. 1772.

Syntherisma Walt., Fl. Carol. 76. 1788.

Spikelets lanceolate or elliptic, nearly plano-convex, in twos or threes, rarely solitary, subsessile or short-pedicelled, alternate in two rows on one side of a 3-angled, winged or wingless rachis, the back of the fertile lemma turned toward it; glumes unequal, the first minute or wanting, the second as long as the spikelet or shorter; sterile lemma as long as the spikelet; fertile lemma cartilaginous, the margins hyaline, not inrolled. Annual or perennial, often weedy grasses with membranous or hyaline ligules and slender racemes digitate or approximate on a short axis.

TYPE SPECIES: *Digitaria sanguinalis* (L.) Scop. (*Panicum sanguinale* L.).

KEY TO THE SPECIES

1. Spikelets 5–6 mm. long; sterile lemma 11–13-nerved.....1. *D. longissima*.
1. Spikelets not more than 3.5 mm. long; sterile lemma 5–7-nerved.
 2. Spikelets 1.5 mm. long.
 3. Spikelets glabrous; plants tufted, less than 10 cm. tall.....9. *D. perpusilla*.

¹² For a discussion of the date and place of valid publication of this generic name see Hitchcock (Rhodora 29: 114–116. 1927). According to the International Rules (Art. 42) the correct citation is "*Digitaria* Heist. ex Haller," and not "Heist. ex Scop." as Hitchcock indicates.

3. Spikelets more or less pubescent; plants larger.
 4. Fertile lemma pale; plants creeping.....7. *D. longiflora*.
 4. Fertile lemma dark brown; plants erect, 40–60 cm. tall....8. *D. violascens*.
2. Spikelets 2.5 mm. or more long (only about 2 mm. in *D. Baileyi*).
 5. First glume wanting or minute; second glume about one-third as long as the spikelet or shorter.
 6. Racemes mostly 8–10, approximate, not digitate; first glume often wanting.4. *D. pruriens*.
 6. Racemes 3–5, digitate or rarely 1 or 2 below; first glume a small deltoid scale5. *D. radicata*.
 5. First glume small but distinct; second glume half as long as the spikelet or longer.
 7. One spikelet of the pair usually undeveloped; blades strict..3. *D. abortiva*.
 7. Both spikelets of the pair well developed; blades lax and spreading.
 8. Sheaths papillose-pilose; spikelets about 3 mm. long....2. *D. sanguinalis*.
 8. Sheaths glabrous; spikelets 2.5 mm. long or shorter.....6. *D. Baileyi*.
1. *Digitaria longissima* Mez, Repert. Sp. Nov. 18: 26. 1922. Type from New Ireland.
Panicum heteranthum Nees & Mey. var. *pachyrachis* Hack., Philip. Jour. Sci. Bot. 3: 167. 1908. Type from the Philippines.
Digitaria heterantha (Nees & Mey.) Merr. var. *pachyrachis* (Hack.) Merr., Enum. Philip. Fl. Pl. 54. 1925.

Perennial; culms glabrous, ascending and creeping, as much as 1 meter long; sheaths glabrous, somewhat keeled; ligule 2–3 mm. long, subtruncate, denticulate; blades flat, rather firm, 5–7 mm. wide, as much as 15 cm. long, both surfaces glabrous, scabrous on the margins; racemes 2–4, digitate, erect or somewhat spreading, 12–18 cm. long, the rachis glabrous, rather broad and thick; spikelets paired, 5–6 mm. long, one nearly sessile, the other on a pedicel about two-thirds the length of the spikelet or longer, the pedicel rather stout and somewhat hollowed out on the side next to the lower spikelet; first glume obsolete, obtuse to bifid; second glume half to two-thirds as long as the spikelet, 3-nerved, silky-pubescent between the nerves; sterile lemma 11–13-nerved, glabrous except for the silky-pubescent margins; fertile lemma pale.

NEW IRELAND: *Peckel 301* (US, TYPE fragment).

New Ireland; Peleliu to the Philippines.

Closely related to *Digitaria barbata* Willd., to which specimens have been referred, but differing in having somewhat larger nearly glabrous spikelets, in which the sterile lemma is 11–13-nerved rather than 7–9-nerved, usually a broader and thicker rachis, and leaves of a somewhat firmer texture. The two also differ in habit, *D. barbata* being very stoloniferous while *D. longissima* has decumbent and creeping culms but no true stolons.

Judging from the original description, *Digitaria Kanchirae* Ohwi (56, p. 543), described from Peleliu, seems referable to *D. longissima*. This latter species is known to occur in Peleliu, since a specimen in the U. S. National Herbarium (*Burcham 150*) was collected there in 1944.

2. *Digitaria sanguinalis* (L.) Scop., Fl. Carn. ed. 2. 1: 52. 1772.

Panicum sanguinale L., Sp. Pl. 57. 1753; Trin., Sp. Gram. Ic. 1: pl. 93, 94. 1828.

Habitat in America and Europe.

Panicum adscendens H.B.K., Nov. Gen. et Sp. 1: 97. 1815. Habitat in tropical America.

Digitaria marginata Link, Enum. Pl. 1: 102. 1821. Type from Brazil.

Digitaria fimbriata Link, Hort. Berol. 1: 226. 1827. Type from Brazil.

Syntherisma sanguinalis (L.) Dulac., Fl. Haut. Pyr. 77. 1867.

Syntherisma fimbriata (Link) Nash, Bull. Torr. Bot. Club 25: 302. 1898.

Syntherisma marginata (Link) Nash, N. Amer. Fl. 17: 154. 1912.

Digitaria adscendens (H.B.K.) Henr., Blumea 1: 92. 1934.

Annual; culms weak and spreading, as much as 1 meter long, profusely branching below, glabrous; sheaths, at least the lower, papillose-pilose; ligule about 2 mm. long, erose; blades 3–8 mm. wide, 4–10 cm. long, glabrous or somewhat pubescent; racemes about 3–10, sometimes only 2, unequal in length, digitate or in two whorls; rachis winged, the wings slightly broader than the central rib, glabrous except for the scabrous margins; spikelets lanceolate-elliptic, about 3 mm. long; first glume small but distinct; second glume half as long as the spikelet or longer, narrow, 3-nerved, ciliate; sterile lemma strongly nerved, the lateral internerves appressed-pubescent, the hairs sometimes spreading at maturity; fertile lemma pale to tawny.

BRITISH NEW GUINEA: Central Division: Hisiu, *Carr 11439* (US, NY).
NORTHEAST NEW GUINEA: Morobe District: Finschhafen, *Sawyer 83, 92* (A).

Common weed in cultivated and waste ground in tropical and temperate regions of both hemispheres.

Extremely variable in the amount of indument on the sterile lemma, some specimens appearing almost glabrous, while others have spikelets which are strongly fimbriate. Plants with this latter condition have been segregated and given varietal or even specific rank (*Digitaria fimbriata* Link). These segregates seem untenable, however, when it is seen that spikelets varying from essentially glabrous to strongly fimbriate may be found in the same inflorescence. *Carr 11439* is exceptional in having a pilose rachis.

Many of the early reports of this species from New Guinea may have been misidentifications for the closely related *Digitaria pruriens*.

3. *Digitaria abortiva* sp. nov. PLATE II.

Annua 25–50 cm. alta; culmis glabris, gracilibus, erectis vel adscendentibus; vaginis carinatis, papilloso-pilosis, quam internodiis longioribus; ligula membranacea, erosa, circiter 2 mm. longa; laminis strictis, lanceolato-linearibus, 2–8 cm. longis, 2–5 mm. latis, utrinque scabris et supra plus minusve papilloso-pilosis; pedunculo longe exserto; racemis 3–4 (rarius 7), digitatis vel approximatis, 4–7 cm. longis, floribus confertis, rhachi anguste alata, ad imam basin minute pubescente, marginibus scabris; spiculis circiter 2.5 mm. longis, plerumque solitariis, ad basin pedicelli abortivum ut videtur spiculum ferentibus; gluma prima scariosa, circiter 0.2 mm. longa, acuta; gluma secunda angusta, 3-nervia, quam spicula circiter tertia parte brevior, marginibus et inter nervos adpresse sericeo-pubescentibus, denique pilis plus minusve patentibus; lemmate sterili 5-nervia, nervis tribus prominentibus, ceteris obscuris, marginibus scariosis, plus minusve sericeo-pubescentibus, inter nervos sparsim pubescente; lemmate fertili straminea vel subfusca.

BRITISH NEW GUINEA: Central Division: Kanosia, *Carr 11108* (US, NY, TYPE), Feb. 5, 1935 (in open savannah land).

Related to *Digitaria sanguinalis*, but differing in the more erect habit, smaller strict leaves, long exserted inflorescence, and smaller spikelets which are usually borne singly rather than in pairs. Comparison may also be made with *D. Henryi* Rendle, but that species has a spreading habit, paired spikelets, glabrous sheaths, and a sterile lemma strongly 5-7-nerved. *Digitaria abortiva* has three strong nerves and usually two additional weak nerves, one on each side of the midnerve. *Digitaria Henryi* is not known from New Guinea. The specific epithet refers to the fact one spikelet of the pair usually fails to develop, being represented merely by a small vestige at the base of the pedicel of the solitary spikelet.

4. *Digitaria pruriens* (Fisch. ex Trin.) Buse in Miquel, Pl. Jungh. 379. 1854; Hitchc., Brittonia 2: 120. 1936.

Panicum pruriens Fisch. ex Trin., Gram. Pan. 77. 1826, Sp. Gram. Ic. 1: pl. 92. 1828; Hack., Bot. Jahrb. 6: 234. 1885. "Ex Inss. Sandw. et Marchion."

Panicum microbachne Presl, Rel. Haenk. 1: 298. 1830.¹³

Digitaria consanguinea Gaud. in Freyc., Voy. Uran. 410. 1830. Type from Hawaiian Islands.

Panicum sanguinale L. var. *microbachne* (Presl) Hack., Bot. Jahrb. 13: 259. 1890; K. Schum., Notizbl. Bot. Gart. Berlin 2: 92. 1898.

Syntherisma pruriens (Fisch. ex Trin.) J. C. Arthur, Torreya 19: 83. 1919.

Syntherisma microbachne (Presl) Hitchc., Mem. Bishop Mus. 8: 177. 1922.

Digitaria microbachne (Presl) Henr., Med. Rijks Herb. Leiden 61: 13. 1930.

Annual; culms ascending or decumbent, as much as 1 meter or more long, glabrous, branching and rooting from the lower nodes; sheaths mostly shorter than the internodes, glabrous to more or less densely papillose-pilose; ligule 2-4 mm. long; blades 5-15 (rarely 20) cm. long, 5-10 mm. wide, lax, glabrous or slightly pubescent below, scabrous and often undulate on the margins; racemes 8-10, aggregated, 8-14 cm. long, erect or somewhat spreading, the rachis angled and with scabrous margins; pedicels angled or narrowly winged, the longer 1.5-2 mm. long; spikelets more or less pubescent, lanceolate-elliptic, 2.5-3 mm. long; first glume wanting or very small, second glume about one-third as long as the spikelet or reduced to a minute nerveless scale; sterile lemma equaling or slightly exceeding the fertile one, 5-7-nerved; fertile lemma pale.

BRITISH NEW GUINEA: Northern Division: About 1 mile north of East Embi Lake, *Reeder 829* (A, US) (in abandoned native garden); Central Division: Mafulu, *Brass 5522* (A, US) (old garden and deforested land); Kanosia, *Carr 11031* (NY) (light shade); Hisiu, *Carr 11440* (NY) (open places); Western Division: Daru Island, *Brass 6305* (A, US) (common weed in gardens); Goodenough Island: Haiwali, *Burcham 120* (US) (grassy clearing in rain-forest). NORTHEAST NEW GUINEA: *Weinland 75* (US); Morobe District: Near Kajabit Mission, alt. about 300 m., *Clemens 10630* (US). NEW BRITAIN: *Parkinson 66* (US).

China to the Philippines, Malaysia, New Guinea, and many Pacific Islands.

¹³ In the original description no habitat is given, but a Haenke sheet in the herbarium of the National Museum, Prague (photograph and fragment at US) shows three specimens. Of these, the center one (a smaller specimen) is labelled "Mexico"; the one on the right bears the label "*Panicum microbachne*," while the one on the left has a label "Sorsogon." The two larger specimens seem to be the same and are taken as the type. The photograph and spikelets agree well with Presl's description. This would make the type locality Sorsogon, Luzon, Philippines.

Closely related to *Digitaria sanguinalis*, but differing in having an obsolete first glume and the second glume obsolete to one-third the length of the spikelet.

5. *Digitaria radicata* (Presl) Miq., Fl. Ind. Bat. 3: 437. 1855.

Panicum radicosum Presl, Rel. Haenk. 1: 297. 1830. Type from the Philippines.

Annual; culms ascending, 40–80 cm. long, branching and rooting from the lower nodes; sheaths mostly shorter than the internodes, the lower often somewhat pubescent, the upper glabrous; ligule 1–2 mm. long, truncate, erose; blades 4–12 cm. long, 4–7 mm. wide, scaberulous on both surfaces, sometimes with a few hairs on the upper surface near the ligule, margins scabrous and often undulate, midnerve prominent, whitish; racemes usually about 3 (sometimes only 2 or as many as 5), digitate, mostly 7–15 cm. long, suberect to somewhat spreading, the rachis narrowly winged; spikelets paired, lanceolate, about 3 mm. long; first glume minute but evident; second glume about one-third the length of the spikelet, narrow, pubescent along the margins; sterile lemma about equaling the fertile one, appressed-pubescent along the margins, the soft white hairs often somewhat spreading; fertile lemma pale.

BRITISH NEW GUINEA: Northern Division: About 9 miles northwest of Oro Bay, Reeder 817 (A, US) (in jungle clearing, forming mats); Western Division: Gaima, Lower Fly River, Brass 8324 (A, US) (abundant as a weed in native gardens). NETHERLANDS NEW GUINEA: Balim River, alt. 1600 m., Brass 11813 (A, US) (abundant as a weed in old gardens); Nassau Region, Explorat Biv., Docters van Leeuwen 10498 (NY).

China to the Philippines and New Guinea.

Closely related to *Digitaria pruriens*, but a more delicate species with thinner, narrower blades, more slender culms, essentially glabrous foliage, and fewer, more lax racemes.

6. *Digitaria Baileyi* (Benth.) Hughes, Kew Bull. 1923: 308. 1923.

Panicum Baileyi Benth., Fl. Austral. 7: 471. 1878; F. M. Bailey, Compr. Cat. Queensl. Pl. fig. 586. 1909–13. Type from Australia.

Culms ascending or suberect, 50–100 cm. tall, slender, glabrous, but the lower internodes under a lens very minutely papillose-roughened, the nodes glabrous; sheaths scaberulous, shorter than the internodes, slightly keeled toward the summit, the hyaline margins extending into slight auricles 2–3 mm. long connected by the slightly shorter brownish ligule; blades flat, 7–14 cm. long, 3–5 mm. wide, scabrous on both surfaces, the pale midnerve rather prominent below; inflorescence long-exserted, of 6–9 slender ascending to spreading racemes on a slender angled axis about 8 cm. long, the lower two often rather distant; racemes 6–15 cm. long, the slender angled rachis puberulent in the axil, scabrous on the angles, interrupted below, the lowermost with appressed branchlets of 2–4 spikelets at the base; pedicels angled, scabrous, the longer about 2 mm. long; spikelets in pairs or often in threes, 2–2.5 mm. long; first glume hyaline, minute to nearly 0.5 mm. long; second glume about half to three-fourths as long as the spikelet, 3–5-nerved, fringed with silky hairs about 0.5 mm. long; sterile lemma 7-nerved, the outer internerves on each side bearing silky hairs similar to those of the second glume, these appressed to somewhat spreading; fertile lemma pale.

BRITISH NEW GUINEA: Central Division: Astrolabe Range, *Arnot 38* (US); Western Division: Tarara, Wassi Kussa River, *Brass 8695* (A, US) (common weed in deserted gardens).

Australia and New Guinea.

Brass 8695 was cited by Chase (17, p. 307) as *Digitaria quinhoensis* A. Camus (type fragment at US), an Indo-Chinese species of similar size and habit but bearing larger spikelets (3 mm. long), which are much less pubescent and have the first pair of lateral nerves on the sterile lemma close to the midrib, the second glume only about one-third as long as the spikelet, and a fertile lemma which is brown at maturity.

7. *Digitaria longiflora* (Retz.) Pers., Syn. Pl. 1: 85. 1805; Hitchc., U. S. Dept. Agric. Misc. Publ. 243: 171. fig. 110. 1936.

Paspalum longiflorum Retz., Obs. Bot. 4: 15. 1786. Type from India.

Panicum longiflorum (Retz.) Gmel., Syst. Nat. 2: 158. 1791.

Syntherisma longiflora (Retz.) Skeels, U. S. Dept. Agric. Bur. Pl. Indust. Bull. 261: 30. 1912.

Perennial; culms glabrous, creeping and producing stolons, forming dense mats, the upright flowering portion about 15 cm. or more tall; sheaths glabrous, shorter than the internodes; ligule membranous, more or less truncate, erose, about 1 mm. long; blades ovate-lanceolate, about 1.5–2 cm. long, 3 mm. wide, glabrous on both surfaces, the margins slightly coriaceous-thickened and scaberulous; racemes mostly in pairs, densely flowered, 3–4 cm. long, the slender rachis winged, glabrous, the wings broader than the midnerve; pedicels terete, glabrous, the longer not more than 1 mm.; spikelets minutely pubescent, about 1.5 mm. long and 0.6 mm. broad; first glume a delicate hyaline scale; second glume equaling the spikelet, 5-nerved; sterile lemma 7-nerved; fertile lemma pale.

BRITISH NEW GUINEA: Northern Division: About 9 miles northwest of Oro Bay, *Reeder 811* (A, US) (forming dense mats at the edge of a water hole).

Japan to India, Malaysia, and New Guinea. Introduced in tropical America.

8. *Digitaria violascens* Link, Hort. Berol. 1: 229. 1827; Hitchc., U. S. Dept. Agric. Misc. Publ. 243: 170. fig. 109. 1936; Chase, Jour. Arnold Arb. 24: 86. 1943. Type from Brazil.

Panicum violascens (Link) Kunth, Rev. Gram. 1: 33. 1829; Hack., Bot. Jahrb. 13: 259. 1890.

Paspalum chinensis Nees in Hook. & Arn., Bot. Beechey Voy. 231. 1836. Type from China.

Paspalum minutiflorum Steud., Syn. Pl. Glum. 1: 17. 1854 (non Desv. 1831); F. Muell., Vict. Nat. 1: 168. 1884. Type from China.

Digitaria chinensis (Nees) A. Camus, Not. Syst. Lecomte 4: 48. 1923 (non Hornem. 1819).

Syntherisma chinensis (Nees) Hitchc., Contr. U. S. Nat. Herb. 22: 468. 1922.

Annual; culms erect, tufted, slender, 50–70 cm. tall, glabrous; sheaths glabrous, mostly shorter than the internodes; ligule more or less truncate, slightly erose; blades glabrous, linear, 6–15 cm. long, 3–6 mm. wide; racemes 3–7, 6–12 cm. long, densely flowered, digitate or approximate on a short axis, the glabrous rachis about 0.5 mm. wide, broadly winged and scaberulous along the margins; pedicels terete to slightly flattened, minutely scabrous, as much as 2 mm. long; spikelets elliptic, about 1.5 mm. long and 0.7 mm. wide; first glume wanting; second glume slightly shorter than the spikelet, 3-nerved, pubescent between the nerves and along the

margin; sterile lemma about equaling the fertile one with 3 distinct nerves and one or two obscure pairs, and with indument like that of the second glume; fertile lemma dark brown at maturity.

BRITISH NEW GUINEA: Northern Division: About 9 miles northwest of Oro Bay, *Reeder 833* (A, US) (in old abandoned jeep trail). NORTHEAST NEW GUINEA: Morobe District: Above Molambling River, alt. about 2000 m., *Clemens 10359* (US). NETHERLANDS NEW GUINEA: Balim River, alt. 1600 m., *Brass 11822* (A, US) (sandy soil on deforested slopes).

Tropics of both hemispheres.

Readily distinguished from *D. longiflora* by its erect habit, longer leaves and racemes, and the dark brown fertile lemma.

9. *Digitaria perpusilla* Pilger, Bot. Jahrb. 69: 253. 1938.

Annual; culms slender, tufted, 4–7 cm. tall, glabrous; sheaths longer than the internodes, pilose, the hairs spreading, white, about 0.5 mm. long; ligule about 0.5 mm. long, more or less truncate, slightly erose; blades lanceolate, 6–8 mm. long, about 1 mm. wide, somewhat pilose with hairs similar to those of the sheath, the margins coriaceous-thickened and scaberulous; racemes in pairs, up to 20 mm. long, the slender rachis somewhat winged, scaberulous on the margins, glabrous, rather densely flowered, the pedicels up to 1.3 mm. long, mostly shorter; spikelets glabrous, elliptic, about 1.2 mm. long and 0.6 mm. wide; first glume wanting; second glume about two-thirds the length of the spikelet, 3-nerved, the margins hyaline; sterile lemma as long as the spikelet, 7-nerved, the three central nerves close together; fertile lemma dark brown at maturity, somewhat indurated except for the hyaline margins; palea similar to the lemma in texture; caryopsis oblong-ellipsoidal, white, the embryo small (about one-third the length of the caryopsis), brown.

NORTHEAST NEW GUINEA: Morobe District: Sarawaket, alt. about 3000 m., *Clemens 6120* (A, TYPE COLL., US).

Endemic. Known only from the type collection.

13. *Eriochloa* H. B. K.

Eriochloa H.B.K., Nov. Gen. et Sp. 1: 94. 1815.

Spikelets dorsally compressed, more or less pubescent, solitary or in pairs, short-pedicel or subsessile, in two rows on one side of a narrow, usually hairy rachis, the back of the fertile lemma turned away from it; rachilla below the second glume thickened into a ring- or bead-like callus; first glume wanting or reduced to a minute sheath surrounding the callus and adnate to it; second glume and sterile lemma subequal, membranous, acute or acuminate; fertile lemma indurate, minutely papillose-rugose, the margins slightly inrolled, the apex mucronate or short-awned. Annuals or perennials with terminal panicles consisting of few to many racemes racemose along the main axis.

TYPE SPECIES: *Eriochloa distachya* H.B.K.

1. *Eriochloa procera* (Retz.) C. E. Hubb., Kew Bull. 1930: 256. 1930.

Agrostis procera Retz., Obs. Bot. 4: 19. 1786. Type from India.

Milium ramosum Retz., Obs. Bot. 6: 22. 1791. Type from India.

Eriochloa ramosa (Retz.) Kuntze, Rev. Gen. 2: 775. 1891.

Annual or perennial; culms tufted or solitary, erect or ascending, 30–

100 cm. tall, glabrous or minutely puberulent, the indument more noticeable below the inflorescence; nodes glabrous to rather densely velvety-puberulent; sheaths glabrous or the lower slightly puberulent, keeled above; ligule a ring of whitish hairs 0.6–0.8 mm. long; blades glabrous, 4–20 cm. long, 2–8 mm. wide, flat or involute when dry; racemes few to many, simple or the lower ones branching, rather distant on a flattened puberulent axis about 0.5 mm. wide, scabrous on the angles; pedicels solitary or paired, the longer 1.5–2 mm. long, scabrous-hispidulous, the apex bearing long stiff hairs from one-fourth to as long as the spikelet; spikelets about 3 mm. long, sparsely appressed-pilose; first glume reduced to a minute sheath around the callus; second glume and sterile lemma subequal, 5-nerved, acuminate, the lemma usually slightly shorter, epaleate; fertile lemma pale, minutely rugose, about 2 mm. long, with an hispidulous mucro about 0.5 mm. long or less.

BRITISH NEW GUINEA: Central Division: Aroa River, Carr 11435 (US, NY) (open sandy places).

Warmer regions of the Old World; introduced into tropical America.

A variable and wide ranging species. The cited specimens are somewhat unusual in being erect, densely tufted, and apparently perennial. The leaves are rather narrower than usual and are closely involute. In the character of the spikelets, however, I can find no significant differences.

14. *Paspalum* L.

Paspalum L., Syst. Nat. ed. 10. 2: 855. 1759.

Spikelets plano-convex, or sometimes unequally bi-convex or even concavo-convex, subsessile or short-pedicel, solitary or in pairs, in 2–4 rows on one side of a narrow or winged rachis, the back of the fertile lemma turned toward it; first glume typically wanting (sometimes slightly developed in *P. vaginatum*); second glume and sterile lemma usually similar, membranous (sterile lemma indurate in some specimens of *P. scrobiculatum*); fertile lemma and palea chartaceous-indurate, the margins of the lemma inrolled at maturity. Annual or perennial grasses of various habitat, widely distributed in the warmer regions of both hemispheres.

TYPE SPECIES: *Paspalum virgatum* L. [ûde Pilger, Nat. Pflanzenfam. ed. 2. 14e: 59. 1940].

KEY TO THE SPECIES

1. Plants extensively creeping; long stolons or rhizomes present.
 2. Spikelets glabrous, 3.5–4 mm. long; blades involute.....1. *P. vaginatum*.
 2. Spikelets silky-ciliate on the margin, less than 2 mm. long; blades flat.....2. *P. conjugatum*.
1. Plants not creeping; culms sometimes more or less decumbent and rooting at base.
 3. Spikelets 1.5 mm. long or less; racemes lax, the rachis about 0.3 mm. wide; fertile lemma pale.....3. *P. paniculatum*.
 3. Spikelets 1.8 mm. or more long; racemes not lax, the rachis at least 1 mm. wide; fertile lemma brown at maturity.
 4. Glume and sterile lemma 3-nerved.
 5. Spikelets apiculate, in 4 rows (at least in the central part of the raceme)....6. *P. longifolium*.
 5. Spikelets obtuse, in two rows.....5. *P. orbiculare*.
 4. Glume and sterile lemma 5–7-nerved.....4. *P. scrobiculatum*.

1. *Paspalum vaginatum* Swartz, Prodr. Veg. Ind. Occ. 21. 1788; Trin., Sp. Gram. Ic. 1: *pl.* 120. 1828; Chase, Contr. U. S. Nat. Herb. 28: 41-45. *fig.* 19. 1929; Hitchc., Proc. Linn. Soc. N. S. Wales 54: 145. 1929. Type from Jamaica.
Paspalum littorale R. Br., Prodr. Fl. Nov. Holl. 1: 188. 1810. Type from Australia.
Paspalum distichum L. var. *littorale* (R. Br.) F. M. Bailey, Queensland Grasses 23. 1888; White, Proc. Roy. Soc. Queensl. 34: 15. 1923.

Perennials with long creeping rhizomes and also stoloniferous; flowering culms 8-60 cm. tall, glabrous; sheaths longer than the internodes, overlapping, often keeled, the margins hyaline, glabrous except for a few weak hairs near the ligule; ligule membranous, about 0.5 mm. long; blades 2.5-15 cm. long, 3-8 mm. wide at base, narrower than the summit of the sheath, more or less involute; racemes usually 2 (rarely 3-5), conjugate or closely approximate at first, often spreading or reflexed at maturity; rachis 1-2 mm. wide, 3-angled, often distinctly zig-zag, especially toward the end; spikelets solitary, imbricate, elliptic, glabrous, 3.5-4 mm. long; first glume wanting or rarely slightly developed; second glume and sterile lemma equal, thin, weakly 5-nerved, but the midnerve of the second glume often suppressed, the sterile lemma often transversely undulate; fertile lemma 2.5-3 mm. long, slightly concave-convex, and with a tuft of short stiff hairs at the apex, clasping the palea for only about two-thirds of its length.

BRITISH NEW GUINEA: Gulf Division: Krema, *Brass* 1229 (GH, US); Western Division: Daru Island, *Brass* 6285 (A, US); coast between Oriomo and Fly Rivers, *Brass* 6408 (A, US) (open beach).

Tropical and subtropical coasts of both hemispheres.

Often confused with *P. distichum* L., a closely related species which differs in having more turgid spikelets, an appressed-pubescent rather than glabrous second glume, and the fertile lemma clasping the palea for its entire length.

2. *Paspalum conjugatum* Bergius, Act. Helv. Phys. Math. 7: 129. *pl.* 8. 1762; Trin., Sp. Gram. Ic. 1: *pl.* 102. 1828; K. Schum. and Lauterb., Fl. Deutsch. Schutzgeb. Südsee 176. 1901; Chase, Contr. U. S. Nat. Herb. 28: 162-168. *fig.* 105. 1929; Hitchc., U. S. Dept. Agric. Misc. Publ. 243: 226. *fig.* 177. 1936; Pilger, Nat. Pflanzenfam. ed. 2. 14e: 61. *fig.* 33. 1940. Type from Surinam.

Perennial; extensively creeping with leafy, compressed, wiry stolons, as much as 2 meters long, the upright flowering branches 20-60 cm. tall, simple or sparingly branching, glabrous or the nodes often pubescent, those of the stolons usually conspicuously pilose; sheaths loose, compressed, the margins ciliate, at least on the upper half, often pubescent on the collar, otherwise glabrous; ligule membranous, about 0.5 mm. long and with a ring of white hairs back of it, these as much as 2 mm. long; blades flat, thin, 8-12 cm. long, 5-15 mm. wide, the margins scabrous or ciliate-hispid, usually glabrous below and sparsely pubescent to glabrous above; racemes in pairs, rarely a third below, widely divergent, 8-12 cm. long, the rachis flattened; spikelets solitary, 1.5-1.7 mm. long, ovate, light yellow, conspicuously silky-ciliate on the margins, otherwise glabrous; second glume and sterile lemma equal; fertile lemma pale, not strongly indurate.

BRITISH NEW GUINEA: Central Division: Dieni, Ononge Road, alt. 500 m., *Brass* 3935 (A, US) (common along roadside and covering rest-house clearing); Kanosia, *Carr* 11025 (US); Northern Division: About 7 miles northwest of Oro Bay, *Reeder* 799 (A, US) (in sandy soil of borrow pit, forming mats); West-

ern Division: Gaima, Lower Fly River, *Brass* 8325 (A, US) (massed as a weed in native gardens). NORTHEAST NEW GUINEA: Morobe District: Finschhafen area, four miles south of Langemak Bay, *Sawyer* 34, 108 (A). NETHERLANDS NEW GUINEA: Reese Region, Gelder River, alt. about 100 m., *Docters van Leeuwen* 9252 (GH). SOLOMON ISLANDS: San Cristoval: *Brass* 2817 (GH).

Widely distributed in the tropics and subtropics of both hemispheres.

3. *Paspalum paniculatum* L., Syst. Nat. ed. 10. 2: 855. 1759;¹⁴ Trin., Sp. Gram. Ic. 2: pl. 127. 1829.

Perennial; culms caespitose, suberect or ascending, 50–100 cm. tall, glabrous or the nodes often more or less pubescent with stiff ascending hairs; sheaths usually longer than the internodes, keeled, papillose-hispid to papillose-pilose, the hairs as much as 5 mm. long; ligule about 0.5 mm. long, membranous, and bearing behind it a dense row of white hairs as much as 12 mm. long; blades flat, spreading, 10–40 cm. long, 10–25 mm. wide, from coarsely hispid on both surfaces and with a long tuft of white hairs at the base to scabrous or sometimes glabrous except at base and along the margin, the midnerve prominent beneath; panicle 10–20 cm. long, of numerous spreading to somewhat drooping racemes, the lowermost as much as 10 cm. long; spikelets in pairs, subhemispheric, 1.3–1.5 mm. long, on slender pedicels, crowded along the slender angled rachis; glume and sterile lemma equal, 5-nerved, the lateral pair contiguous, glume loosely pubescent with delicate hairs, the sterile lemma with similar hairs along the margin, sometimes throughout; fertile lemma pale.

BRITISH NEW GUINEA: Northern Division: About 8 miles northwest of Oro Bay, *Reeder* 805 (A, US) (growing in sand at edge of coconut grove); Good-enough Island: Two miles west of Haiwali, *Burcham* 134 (US) (scanty soil among boulders in dense secondary growth near native village).

Mexico and the West Indies to Argentina, West Africa, Society Islands, Australia, and New Guinea.

4. *Paspalum scrobiculatum* L., Mant. 1: 29. 1767; F. Muell., Pap. Pl. 2: 35. 1886. Type from India.

Paspalum cartilagineum Presl, Rel. Haenk. 1: 216. 1830; K. Schum. and Lauterb., Fl. Deutsch. Schutzgeb. Südsee 175. 1901. Type from the Philippines.

Paspalum Zollingeri Steud., Syn. Pl. Glum. 1: 28. 1854; K. Schum., Bot. Jahrb. 9: 195. 1887. Type from Java.

Culms solitary or tufted, 50–100 cm. tall, erect or ascending, sometimes somewhat decumbent and rooting from the lower nodes, often rather stout; sheaths glabrous, longer than the internodes, compressed-keeled, especially toward the summit; ligule membranous, 0.5–1 mm. long, with a row of tawny hairs back of it, or these sometimes wanting or obscure; blades glabrous, firm, flat or folded, 15–50 cm. long, 7–12 mm. wide, the margins scabrous, the upper surface more or less glaucous; racemes 2–5 (rarely up to 8), alternate on a slender, glabrous, angled axis; rachis 1.5–3 mm. wide, the margins minutely scabrous; spikelets solitary, imbricate, glabrous, orbicular to ovate, 2–3 mm. long; second glume membranous, 5-nerved; sterile lemma 5–7-nerved, membranous or sometimes indurate (*P. cartilagineum* Presl); fertile lemma dark brown at maturity.

BRITISH NEW GUINEA: Northern Division: About 9 miles northwest of Oro Bay, *Reeder* 818 (US) (open, low swampy ground); about 3 miles south of

¹⁴ No locality is cited, but in Sp. Pl. ed. 2. 81. 1762, Linnaeus gives the habitat as Jamaica. See Chase, Contr. U. S. Nat. Herb. 28: 122. 1929.

Dobodura, near Sambogo River, *Reeder 826* (US); Gulf Division: Maclatchi Point, *Brass 1183* (GH, US) (in clumps on the beach); Western Division: Daru Island, *Brass 6297* (A, US) (common on wet pathways and in garden clearings); Palmer River, 1 mile above junction with Black River, *Brass 6948* (A, US) (sand binder on gravel banks); Lake Daviumbu, Middle Fly River, *Brass 7529* (A, US) (restricted to swamp margins); Gaimá, Lower Fly River, *Brass 8302* (A, US) (associated with sedges on open sandy foreshores); Goodenough Island: Malauna Creek, *Burcham 129* (US) (scanty moist soil along creek bed and banks). NORTHEAST NEW GUINEA: Morobe District: 4 miles south of Langemak Bay, near Finschhafen, *Sawyer 94* (A). NETHERLANDS NEW GUINEA: Balim River, alt. 1600 m., *Brass 11817* (A, US) (rare on deforested slopes); Bernhard Camp, Idenburg River, alt. 50 m., *Brass 13784* (A, US) (on logs floating in lagoons and quiet backwater).

Tropics and subtropics of the Old World.

A variable species, but readily distinguished by its robust habit and 7-nerved sterile lemma. *Paspalum cartilagineum* is here considered as a synonym, since there is no reliable character by which it may be separated. The indurate sterile lemma might seem to be specific, but this breaks down when it is found that on the same plant both indurate and membranous sterile lemmas may be present. Some spikelets show half the sterile lemma indurate and the other half membranous.

4a. *Paspalum scrobiculatum* L. var. *bispicatum* Hack. ex. Merr., Fl. Manila 86. 1912; Kneuck., Allg. Bot. Zeitschr. 20: 146. 1914. Type from the Philippines.

Distinguished from the species by its slender culms 30–50 cm. tall and its 2 (rarely 3) racemes 3–5 cm. long, usually not more than 1 cm. distant. The inflorescence is typically long exserted on a slender peduncle and the spikelets are orbicular to elliptic, about 2 mm. long.

BRITISH NEW GUINEA: Northern Division: About 9 miles northwest of Oro Bay, *Reeder 815* (A, US) (rather common in wet areas, forming rosette-like clumps); Goodenough Island: Haiwali, *Burcham 122* (US) (grassy clearing in rain-forest; well drained sandy loam).

India to China, the Philippines, and New Guinea.

5. *Paspalum orbiculare* G. Forster, Fl. Ins. Austr. Prodr. 7. 1786; Hack., Bot. Jahrb. 13: 258. 1890; Hitchc., Mem. Bishop Mus. 8(3): 178. fig. 68. 1922. Type from the Society Islands.

Paspalum scrobiculatum L. β *orbiculare* (G. Forster) Hack., Bot. Jahrb. 6: 233. 1885.

Culms tufted, erect, glabrous, 40–80 cm. tall; sheaths glabrous, longer than the internodes, compressed-keeled especially toward the summit; ligule membranous, about 0.75 mm. long; blades elongate, flat or sometimes folded, 5–10 mm. wide, the upper surface somewhat glaucous and sometimes with a few long hairs near the ligule, the margins minutely scabrous; inflorescence long-exserted, consisting of 3–5 (rarely to 7) racemes, 3–6 cm. long, alternate and 1–2 cm. distant on a slender axis; rachis 1.5–3 mm. wide, scabrous on the margins; spikelets glabrous, oval to nearly circular with obtuse apex, about 2 mm. long, usually solitary (occasionally paired), imbricate, in 2 rows (rarely 3 or 4 rows) on the rachis; glume and sterile lemma equal, thin, 3-nerved; fertile lemma brown at maturity.

BRITISH NEW GUINEA: Goodenough Island: Malauna Creek, *Burcham 130* (US) (occasional in moist spots along creek bed and banks). NORTHEAST NEW GUINEA: Morobe District: Four miles south of Langemak Bay (near

Finschhafen), *Sawyer 93* (A); Wantoat, alt. about 1000 m., *Clemens 11047* (US). SOLOMON ISLANDS: San Cristoval: Waimaura, *Brass 2841* (GH).

Tropics and subtropics of the Old World.

Readily distinguished from *Paspalum scrobiculatum* by its 3-nerved glume and sterile lemma and its usually more numerous racemes, which are distant on the axis. The species may also be compared with *P. longifolium*, but that species has apiculate spikelets which are borne in pairs and are in four rows, at least in the central part of the raceme. The racemes are usually much more numerous and the rachis is broader.

6. *Paspalum longifolium* Roxb., Hort. Beng. 7. 1814, nomen, Fl. Ind. 1: 283. 1820, descr.; Trin., Sp. Gram. Ic. 2: pl. 138. 1829; F. Muell., Pap. Pl. 1: 74. 1876. Type from India.

Paspalum flexuosum Klein ex Presl, Rel. Haenk. 1: 215. 1830. Type from the Philippines.

Paspalum cognatum Steud., Syn. Pl. Glum. 1: 28. 1854. Type from Java.

Paspalum scrobiculatum L. var. *philippinensis* Merr., Philip. Jour. Sci. 1: Suppl. 345. 1906. Type from the Philippines.

Paspalum longifolium Roxb. var. *trichocoleum* Hack., Philip. Jour. Sci. Bot. 3: 167. 1908; Hitchc., Brittonia 2: 121. 1936. Type from the Philippines.

Paspalum scrobiculatum L. var. *longifolium* (Roxb.) Domin, Bibl. Bot. 85: 288. 1915.

Perennial; culms solitary or tufted, rather stout, 80–130 cm. tall; sheaths longer than the internodes, compressed-keeled, glabrous to more or less densely papillose-pilose, especially on the margins; ligule membranous, about 2 mm. long, often with a row of tawny hairs behind it; blades glabrous, firm, flat or folded, as much as 60 cm. long, about 6–9 mm. wide, the margins scabrous; racemes 4–12, about 5–8 cm. long, alternate and rather distant along the slender axis, this glabrous or with a few long hairs in the axils of the racemes; rachis 2–4 mm. wide (usually about 3 mm.), the margins scabrous; spikelets apiculate, paired, 4-rowed, at least in the central part of the raceme, broadly obovate, about 2–2.5 mm. long; glume and sterile lemma equal, 3-nerved, minutely crisp-puberulent to glabrous; fertile lemma brown at maturity.

BRITISH NEW GUINEA: Central Division: Hula, *Brass 521* (GH, US) (damp hollows in coast sandhills); Western Division: Dagwa, Oriomo River, alt. 40 m., *Brass 5922* (A, US) (plentiful in pond shallows); Daru Island, *Brass 6341* (A, US) (plentifully scattered through grass swamps in savannah forest). NORTHEAST NEW GUINEA: Morobe District: Near Kajabit Mission, *Clemens 10706* (A, US).

Tropical Asia, the Philippines, to New Guinea.

Apparently closely related to *Paspalum orbiculare*, with which it seems to intergrade. In general it is distinguishable by the more numerous racemes with 4-rowed, apiculate spikelets, and longer leaves. Most specimens of *P. longifolium* have pubescent spikelets, but all gradations may be found from those densely crisp-puberulent, through those only sparsely so, to specimens which are completely glabrous. Probably the most reliable character is the apiculate spikelet.

15. *Setaria* Beauv.

Setaria Beauv., Ess. Agrost. 51. pl. 13, fig. 3. 1812. nom. conserv. (non *Archarius* 1789, nec Michx. 1803).

Chaetochloa Scribn., U. S. Dept. Agric. Div. Agrost. Bull. 4: 38. 1897.

Spikelets dorsally compressed, elliptic or lanceolate, solitary or clustered, some or all subtended by one to several bristles (sterile branches), articulate on short discoid-tipped pedicels and falling free from the bristles; first glume broad, usually less than half the length of the spikelet, 3-5-nerved; second glume and sterile lemma equal or the former shorter, 5-7-nerved; fertile lemma indurate, smooth or prominently transversely rugose, the margins inrolled. Annuals or perennials with narrow, usually spikelike or rarely open panicles.

TYPE SPECIES: *Setaria viridis* (L.) Beauv. (*Panicum viride* L.).

KEY TO THE SPECIES

1. Panicle open; bristles single, below only part of the spikelets; leaves broad, plicate.1. *S. palmaefolia*.
1. Panicle densely cylindric or more or less lobed; bristles few to several, below all the spikelets; leaves not plicate.
 2. Bristles below each spikelet numerous, at least more than 5; spikelets solitary, or sometimes with a rudimentary second, on the panicle branches.
 3. First glume acuminate; second glume as long as the spikelet or one-fourth shorter.5. *S. surgens*.
 3. First glume acute or obtuse; second glume not more than two-thirds as long as the spikelet.
 4. Spikelets 2-2.2 mm. long; second glume half as long as the spikelet; sterile lemma strongly nerved.4. *S. pallide-fusca*.
 4. Spikelets 2.6-3 mm. long; second glume more than half as long as the spikelet; sterile lemma faintly nerved.6. *S. montana*.
 2. Bristles below each spikelet 1-3; spikelets usually 3 or more (rarely single on depauperate plants) on the panicle branches.
 5. Fertile floret falling free from the glumes and sterile lemma.3. *S. italica*.
 5. Fertile floret falling together with the glumes and sterile lemma.2. *S. viridis*.
1. *Setaria palmaefolia* (Koenig) Stapf, Jour. Linn. Soc. Bot. 42: 186. 1914; Hitchc., Brittonia 2: 124. 1936.
Panicum palmaefolium Koenig, Naturf. 23: 208. 1788. Type from Siam.
Panicum palmifolium Willd. ex Poir. in Lam., Encycl. Suppl. 4: 282. 1816. Based on *P. plicatum* Willd., Enum. Hort. Berol. 2: 1033. 1809 (non Lam. 1791). Type from India.
Panicum nervosum Roxb., Hort. Beng. 8. 1814, nomen, Fl. Ind. 1: 314. 1820, descr. (non Lam. 1798). Type from Nepal.
Panicum neurodes Schult., Mant. 2: 228. 1824. Based on *P. nervosum* Roxb.
Panicum sulcatum sensu K. Schum., Notizbl. Bot. Gart. Berlin 2: 93. 1898.
Chaetochloa palmifolia (Willd. ex Poir.) Hitchc. and Chase, Contr. U. S. Nat. Herb. 18: 348. 1917; Hitchc., Contr. U. S. Nat. Herb. 22: 161-162. fig. 38. 1920.

Perennial; culms erect, caespitose or with short rhizomes, 60-200 cm. tall; sheaths usually overlapping, rather loose, keeled, papillose-hispid or glabrous; ligule a dense ring of hairs 1.5-2 mm. long; blades scabrous, often pubescent below, as much as 40 cm. long and 6.5 cm. wide, strongly plicate, acuminate, narrowed to a petiole-like base; panicle loose and open, as much as 40 cm. long; the branches ascending or spreading, the lower somewhat distant, as much as 15 cm. long, the spikelets crowded on short branchlets appressed along the main branches, the bristles 5-15 mm. long, sometimes short and inconspicuous; spikelets 3-4 mm. long, lanceolate, acute, the margins of the glumes and sterile lemma more or less hyaline; first glume 3-nerved, ovate, acute or obtuse, one-third to half

the length of the spikelet; second glume 5-nerved, half to nearly as long as the spikelet, the apex acute; sterile lemma equaling or slightly exceeding the fertile, 5-nerved, acuminate, and with a short incurved point, enclosing a hyaline palea; fertile lemma faintly transversely rugose.

BRITISH NEW GUINEA: Central Division: Vanapa Valley, Urunu, alt. 1900 m., *Brass* 4792 (GH, US) (common on damp stream banks on deforested land); Kanosia, *Carr* 11355 (NY) (banks of river); Goodenough Island: Malauna Creek, about 1 mile west of Haiwali, *Burcham* 133 (US). NORTHEAST NEW GUINEA: Morobe District: Dreger Harbor, near Finschhafen, *Reeder* 885 (A, US) (along roadside); Sepik River, *Herre* 313 (NY). NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, alt. 2200 m., *Brass* 11471 (A, US) (occasionally associated with *Imperata* on formerly cultivated slopes); 4 km. southwest of Bernhard Camp, Idenburg River, alt. 850 m., *Brass* 13263 (A, US) (rain-forest; common in open seral growths on river flood plain); Nassau Region, Explorat Biv., alt. about 1200 m., *Docters van Leeuwen* 10814 (GH). SOLOMON ISLANDS: Bougainville: *Kajewski* 1779 (GH).

2. *Setaria viridis* (L.) Beauv., Ess. Agrost. 51, 171, 178. *pl.* 13, fig. 3. 1812; Hack., Denkschr. Akad. Wiss. Math.-Naturw. (Wien) 89: 495. 1913.

Panicum viride L., Syst. Nat. ed. 10. 2: 870. 1759; Trin., Sp. Gram. Ic. 2: *pl.* 203. 1829. Type from Europe.¹⁵

Chaetochloa viridis (L.) Scribn., U. S. Dept. Agric. Div. Agrost. Bull. 4: 39. 1897.

Annual; culms tufted or solitary, erect or geniculate at base, 30–60 (10–100) cm. tall; sheaths rather loose, glabrous or papillose-hispid, ciliate on the margins and sometimes slightly ciliate on the collar; ligule short, densely ciliate; blades flat, 5–30 cm. long, 2–18 mm. wide, scabrous, especially above; panicle densely cylindric, erect or nodding, 5–10 (2–20) cm. long, the axis and branches pubescent; branches variable in length, bearing 3–6 spikelets (sometimes very short and reduced to 2 or 3 spikelets, or in giant specimens the branches 1 cm. or more long and very densely flowered); bristles 1–3 below each spikelet, mostly 4–12 mm. long, green or yellowish, or sometimes purple; spikelets 2–2.5 mm. long, 0.8–1 mm. wide, elliptical, usually obtuse; first glume 3-nerved, ovate, about one-third as long as the spikelet; second glume 5-nerved, equaling the spikelet or slightly shorter; sterile lemma 5-nerved, enclosing a small narrow palea; sterile lemma oblong, obtuse, obscurely rugose.

A cosmopolitan weedy species.

Although no specimens from New Guinea have been seen, this species is included since it was reported from New Britain by Hackel (25, p. 495) and is to be expected from New Guinea.

3. *Setaria italica* (L.) Beauv., Ess. Agrost. 51, 170, 178. 1812.

Panicum italicum L., Sp. Pl. 56. 1753; Trin., Sp. Gram. Ic. 2: *pl.* 198. 1829. Type from India.

Pennisetum italicum (L.) R. Br., Prodr. Fl. Nov. Holl. 1: 195. 1810.

Chaetochloa italica (L.) Scribn., U. S. Dept. Agric. Div. Agrost. Bull. 4: 39. 1897.

A cultivated form of *Setaria viridis*; culms usually stout, 30–150 cm. tall; blades as much as 45 cm. long and 2.5 cm. wide; panicles 10–30 cm. long, usually strongly lobate and drooping, sometimes as much as 3 cm. thick; bristles from scarcely as long as the spikelets to 3 or 4 times as long; spikelets 2–3 mm. long, the fertile floret smooth or nearly so, tawny to red, brown, or black at maturity, falling away from the glumes and sterile

¹⁵ See Hitchcock, Contr. U. S. Nat. Herb. 22: 187. 1920.

lemma. The plants often propagate themselves in fields and waste places and then tend to revert to a more primitive form. Such plants are often difficult to distinguish from *S. viridis*, since the disarticulation of the "fruit" is often evident only at maturity, and even then is often not well marked in the uncultivated plants.

NETHERLANDS NEW GUINEA: Biak Island: Bosnek Bay, *M. E. Britton* 22 (A).

Widely cultivated for its grains in many parts of the world; also escaped and appearing more or less as a waif in waste places.

F. T. Hubbard (*Am. Jour. Bot.* 2: 187. 1915) proposes three subspecies based on the color of the mature "fruit." The cited specimen apparently belongs to subspecies *stramineofructa* F. T. Hubb.

4. *Setaria pallide-fusca* (Schum.) Stapf and C. E. Hubb., *Kew Bull.* 1930: 259. (July) 1930, in Prain, *Fl. Trop. Afr.* 9: 815. (Aug.) 1930; C. E. Hubb. and Vaughan, *Grass. Maurit. and Rodriguez* 68. fig. 11a. 1940.

Panicum pallide-fuscum Schum., *Beskr. Guin. Pl.* 78. 1827. Type from West Africa.

Annual; culms more or less compressed, erect or ascending (sometimes sprawling), 30–100 (rarely to 150) cm. tall, branching below, often more or less decumbent and rooting from the lower nodes, more or less pubescent just below the panicle, otherwise glabrous; nodes glabrous, dark brown; sheaths glabrous, rather loose, compressed-keeled, the margins scarious; ligule a ciliate membrane about 1 mm. long; blades flat or folded (sometimes involute), 10–20 (rarely to 40) cm. long, 3–8 mm. wide, glabrous or more or less pilose above near the ligule; panicle long-exserted, dense, spike-like, evenly cylindric, 5–8 (3–15) cm. long, the rachis and branchlets densely pubescent; bristles numerous, 2–3 times the length of the spikelets; spikelets elliptical, 2–2.2 mm. long, about 1 mm. wide; first glume 3-nerved, about 0.8 mm. long, obtuse to acute; second glume 5-nerved, about half as long as the spikelet, obtuse; sterile lemma prominently 5-nerved, enclosing a well-developed palea and rarely a staminate flower; fertile lemma 2 mm. or less long, transversely rugose, rounded or slightly angled on the back, the apex acute, often very slightly mucronate.

BRITISH NEW GUINEA: Central Division: Mafulu, alt. 1250 m., *Brass* 5482 (GH, US) (roadsides and sometimes on artificial grassland); Western Division: Wuroi, Oriomo River, alt. 10–30 m., *Brass* 5740 (GH, US); Daru Island, *Brass* 6270 (A, US) (plentiful on damper soils of savannah forests); Lake Daviumbu, Middle Fly River, *Brass* 7883 (A, US) (restricted to patches of damper soil in savannahs); Northern Division: About 7 miles northwest of Oro Bay, *Reeder* 804 (A, US) (occasional in wet areas); south of Cape Sudest, *Reeder* 855 (A, US) (growing thickly along abandoned jeep trail); Goodenough Island: Haiwali, *Burcham* 125 (US) (grassy clearing in rain-forest). NORTHEAST NEW GUINEA: Morobe District: Kajabit, Markham Valley, *Clemens* 10540J (US); Finschhafen, *Weinland* 357 (US). NETHERLANDS NEW GUINEA: Balim River, alt. 1600 m., *Brass* 11814 (US) (abundant in abandoned gardens); Waren, 60 miles south of Manokwari, alt. 10 m., *Kanekira and Hatusima* 13371 (A) (in open grass-field).

Tropical and South Africa to tropical Asia, northern Australia, and Polynesia.

The cited specimens, though varying considerably in size and habit, are remarkably uniform in spikelet characters. Although the spikelets are slightly smaller than is usual for African specimens of this species, they

seem to differ in no other important respect. *Reeder 855* has a rather unusual habit, being weak-stemmed and sprawling, but in the character of the spikelets it seems identical with the others cited.

Specimens of this species have been referred to *Setaria geniculata* (Lam.) Beauv., a perennial species with larger and broader spikelets, in which the sterile lemma is 7- rather than 5-nerved.

5. *Setaria surgens* Stapf, Kew Bull. 1909: 265. 1909. Type from Netherlands New Guinea.

Perennial, but often flowering the first year and appearing annual; culms caespitose, often geniculate at base, 30–45 cm. tall, fluted above, pubescent below the panicle, otherwise glabrous or scabrous; nodes glabrous, dark brown to black; ligule a row of hairs 0.3–0.5 mm. long; blades flat, often involute in drying, 8–18 cm. long, 2–4 (rarely 5) mm. wide, scabrous on the margins, glabrous beneath, spreading-pilose above, the hairs weak, 2–3 mm. long; panicle spike-like, long-exserted, densely flowered, 3–5 cm. long, the rachis and branchlets pubescent; branches opposite or whorled, the bristles 6–8, about 8–12 mm. long; spikelets obovate-elliptic, solitary, 2.3–2.6 (rarely 3) mm. long; first glume 3-nerved, ovate, acuminate, half to two-thirds as long as the spikelet; second glume ovate, 5-nerved, as long as the spikelet or about one-fourth shorter; sterile lemma equaling the fertile one, 5-nerved, apiculate, enclosing a thin palea as long as the lemma and with two marginal nerves, these sometimes showing through the sterile lemma and making it appear 7-nerved; fertile lemma transversely rugose, broadly angled on the back.

BRITISH NEW GUINEA: Central Division: Hisiu, *Carr 11382* (NY) (open places near sea shore); Western Division: Near Dutch Boundary [Fly River], *MacGregor 11, 13* (US).

Australia and New Guinea.

Closely related to *Setaria apiculata* (Scribn. and Merr.) K. Schum., from Australia, but may be distinguished by its more densely flowered panicles and smaller, differently shaped spikelets, those of *S. apiculata* being broadly ovate and 3–3.5 mm. long, while those of *S. surgens* are obovate-elliptic and about 2.5 mm. long. Both of these species are characterized by an acuminate first glume and apiculate sterile and fertile lemmas.

Although Stapf's original description states that the first glume is "acute to apiculate," a specimen in the U. S. National Herbarium with an acuminate first glume was seen by C. E. Hubbard of Kew, who states that the spikelets agree perfectly with those of a specimen cited by Stapf with the original description of *S. surgens*. The type of *S. surgens* is not at Kew.

6. *Setaria montana* sp. nov. PLATE III.

Perennis? vel annua plerumque 40–80 cm. alta; culmis compressis, ascenduntibus ad basin geniculatis, infra paniculam pubescentibus, ceterum glabris; nodis fuscis vel nigrescentibus, eis infra medium culmum saepe ramiferis; vaginis carinatis, glabris, quam internodiis brevioribus, plus minusve laxis, marginibus scariosis; ligula membranacea, ciliata, 0.5–0.8 mm. longa; laminis linearibus, saltem in sicco subinvolutis, 10–20 (raro ad 30) cm. longis, 2–5 mm. latis, subtus glabris, supra scabris et praecipue

prope basin plus minusve pilosis; panícula solitaria, dense spiciformi, 4–10 cm. longa, 5–8 mm. diametro, rhachi et ramis dense pubescentibus, ramis circiter 5 mm. longis; setis circiter 8–10, inaequalibus, usque ad 4–5 (raro ad 8) mm. longis, scabris, ferrugineis vel purpureis; spiculis ellipticis, 2.6–3 mm. longis, circiter 1.3 mm. latis, solitariis vel binatis quarum uno abortivo; gluma prima late ovata, acuta, 1.2–1.4 mm. longa, nervis 3–5, prominulis; gluma secunda late ovata, obtusa, quam spicula circiter tertia parte brevior, 5-nervia, nervis prominulis; lemmate sterili spicula aequante, nervis 3–5, obscuris; lemmate fertili ovata, mucronulata, transverse rugulosa, quam sterili paullo brevior.

BRITISH NEW GUINEA: Central Division: Urunu, Vanapa Valley, alt. 1900 m., *Brass* 4788 (A, US) (conspicuous on open grasslands and fallow garden clearings). NORTHEAST NEW GUINEA: Morobe District: Ogeramnang, alt. about 1750 m., *Clemens* 4498 (A). NETHERLANDS NEW GUINEA: 9 km. northeast of Lake Habbema, alt. 2800 m., *Brass* 10746 (A, US) (plentiful on a native clearing in the forest; habit ascending and clump-forming; inflorescence reddish-brown); 18 km. northeast of Lake Habbema, alt. 2200 m., *Brass* 11488 (A, TYPE, US) Nov. 1938 (very abundant on old garden lands; habit ascending); Balim River, alt. 1600 m., *Brass* 11814 (A) ¹⁶ (abundant in abandoned gardens).

In some respects this species suggests the highly variable *Setaria geniculata* (Lam.) Beauv., but it differs in having a more slender panicle, longer and narrower spikelets with faintly 5-nerved rather than prominently 7-nerved sterile lemmas, usually much shorter bristles, and narrower subinvolute rather than flat blades. Comparison may also be made with *S. pallide-fusca*, but that species is definitely an annual with broader blades and smaller spikelets, in which the second glume is only half the length of the spikelets and the sterile lemma is prominently nerved. The cited specimens were all collected at elevations of 1600 meters or more.

16. *Pseudoraphis* Griff.

Pseudoraphis Griff., Not. ad Pl. Asiat. 3: 29. 1851; Pilger, Notizbl. Bot. Gart. Berlin 10: 209. 1928.

Spikelets lanceolate, attenuate, dorsally compressed, 2-flowered, the lower staminate, the upper pistillate, short-pedicel along the slender simple branches of the panicle, the back of the fertile lemma turned toward it; the branches produced beyond the spikelets into a slender bristle and finally disarticulating from the main axis; first glume nerveless, hyaline; second glume attenuate, 5-many-nerved; sterile lemma shorter than the second glume, acuminate, with a nerveless palea and a staminate flower; fertile floret pistillate, much shorter than the sterile lemma, membranous or very slightly indurated; caryopsis obovate-oblong, exposed beyond the lemma and palea at maturity. Aquatic or marsh perennials with simple contracted or narrow panicles, the branches stiffly ascending.

TYPE SPECIES: *Pseudoraphis Brunoniana* Griff.

1. *Pseudoraphis squarrosa* (L. f.) Chase, Jour. Arnold Arb. 20: 313. 1939.
Andropogon squarrosus L. f., Suppl. Pl. 433. 1781. Type from Ceylon.
Panicum asperum Koenig, Naturf. 23: 209. 1788 (non Lam. 1778).. Type from East Indies.

¹⁶ This collection consisted of a mixture, and the specimen under this number at the U. S. National Herbarium is *Setaria pallide-fusca*.

Chamaeraphis aspera (Koenig) Nees in Wall. Cat. No. 8679. 1849.

Pseudoraphis aspera (Koenig) Pilger, Notizbl. Bot. Gart. Berlin 10: 210. 1928; Blatter and McCann, Imp. Council Agric. Res. Sci. Monogr. 5: *pl.* 109. 1935.

Culms prostrate, rooting from the lower nodes, as much as 3–4 meters long, the ascending flowering portion 30–70 cm. tall, more or less branched, glabrous except for the more or less pubescent nodes; sheaths glabrous, rather loose, often prolonged into two sharp auricles, one on either side of the ligule and equal to it; ligule about 1 mm. long, membranous, erose; blades flat to involute, lanceolate-linear, 3–6 cm. long, 2–4 mm. wide, scabrous on the margins, the base often narrowed into a distinct petiole about 1 mm. long; panicle 6–14 cm. long, the slender scabrous branches several-flowered, stiffly ascending, the lowermost as much as 6 cm. long; spikelets lanceolate, acuminate, 5–7 mm. long, solitary, on pedicels about 0.5 mm. long; first glume truncate or rounded, hyaline, about 0.5 mm. long; second glume 5–7 mm. long, acuminate, scabrous to hispid on the nerves, the hairs sometimes tuberculate-based; sterile lemma somewhat shorter than the second glume, similar to it or lighter in color and with the nerves obscure, acuminate, glabrous or somewhat scabrous, enclosing a palea and a staminate flower; fertile lemma pistillate, 1.6–1.8 mm. long, membranous; mature caryopsis much exceeding the lemma and palea.

BRITISH NEW GUINEA: Western Division: Lake Daviumbu, Middle Fly River, *Brass* 7600 (A, US) (rooting in shallows of swamps); Penzara, between Morehead and Wassi Kussa Rivers, *Brass* 8470 (A, US) (in shallows of a permanent water hole).

India to the East Indies, Philippines, and New Guinea.

17. *Pennisetum* Rich.

Pennisetum Rich. in Pers., Syn. Pl. 1: 72. 1805.

Penicillaria Willd., Enum. Pl. Hort. Berol. 2: 1036. 1809.

Gymnothrix Beauv., Ess. Agrost. 59. *pl.* 13, fig. 6. 1812.

Spikelets lanceolate, sessile or short-pedicelled, solitary or two to three together surrounded by an involucre of bristles (sterile branchlets), the fascicles subsessile or short-peduncled, usually crowded on a common axis and falling entire with the spikelets enclosed; glumes shorter than the spikelet, unequal, the first smaller, thin, usually nerveless, the second 1-nerved; sterile lemma few to several-nerved, acute or awn-pointed, enclosing a palea and often a staminate flower; fertile lemma equaling the sterile or shorter, smooth, chartaceous, rounded on the back, the margins thin, flat, enclosing a similar palea. Annuals or perennials with usually flat blades and dense spikelike panicles.

TYPE SPECIES: *Pennisetum typhoideum* Rich. = *P. spicatum* (L.) Koernicke (*Holcus spicatus* L.).

1. *Pennisetum macrostachyum* (Brongn.) Trin., Mém. Acad. St. Petersb. VI. Sci. Nat. 1: 177. 1834; F. Muell., Vict. Nat. 1: 168. 1884.

Gymnothrix macrostachys Brongn. in Duperry, Bot. Voy. Coquille 2 (2): 104. *pl.* 11. 1831. Type from the Moluccas.

Culms erect, glabrous, 2–3 meters tall, 1–2 cm. in diameter near the base, freely branching; sheaths usually overlapping, rather loose, somewhat keeled toward the summit; ligule membranous, 0.2 mm. long or less; blades flat, 20–40 cm. long, 1–3 cm. wide, glabrous or scabrous, the midrib rather prominent beneath; panicle nodding, 15–30 cm. long; spikelets

solitary, 5–6 mm. long, subtended by fine, minutely antrorsely scabrous hair-like bristles as much as 3 cm. long; glumes hyaline, the first nerveless, about half as long as the second, this 2.5–3 mm. long, 1-nerved; sterile and fertile lemma about equal, the sterile 5-nerved, with sometimes obscure lateral nerves, acuminate or short awn-tipped at apex, empty or enclosing a palea and sometimes a staminate flower; fertile lemma chartaceous-indurate, smooth, the apex acuminate or short awn-tipped, the margins hyaline, not inrolled; palea scaberulous on the upper half.

BRITISH NEW GUINEA: Central Division: Laloki River, *Brass* 538 (GH, US), *Brass* 3610 (A, US) (savannah gullies or in shelters of rocks); Mafulu, alt. 1250 m., *Brass* 5513 (A, US) (forms small thickets in regrowth brush); Veiya, *Carr* 11658 (US); Western Division: Daru Island, *Brass* 6397 (A, US) (gregarious in thickets 2–3.5 meters high). NORTHEAST NEW GUINEA: Morobe District: Near Kajabit Mission, *Clemens* 40793 (US); Wantoat, *Clemens* 41172 (US); Finschhafen, *Lauterbach* 24 (US). NETHERLANDS NEW GUINEA: Hollandia and vicinity, alt. 10 m., *Brass* 8893 (A, US) (forming thickets 2–3 meters high on dry gravel beds in river); Balim River, alt. 1600 m., *Brass* 11777 (A, US) (abundant on dry stony soil); Rouffaer River, alt. about 100 m., *Docters van Leeuwen* 9727 (GH). NEW BRITAIN: *Naumann* in 1875 (US). SOLOMON ISLANDS: Bougainville: *Kajewski* 2245 (GH); Ysabel: Tinibuli, *Herre* 132 (NY).

East Indies and the Philippines to New Guinea and Australia.

18. *Cenchrus* L.

Cenchrus L., Sp. Pl. 1049. 1753.

Spikelets sessile, one to several together, permanently enclosed in a bristly or spiny involucre or bur, composed of more or less coalesced sterile branchlets; burs sessile or nearly so on a slender axis, its apex produced into a short point beyond the uppermost bur, the burs falling entire, the grains germinating within them; spikelets lanceolate; glumes membranous, the first 1-nerved, narrow, sometimes wanting, the second 3–5-nerved, usually shorter than the spikelet; sterile lemma about equal to the fertile one, membranous, 3–5-nerved, enclosing a well-developed palea and often a staminate flower; fertile lemma indurate, membranous near the tip, the margins clasping the palea but not inrolled. Annuals (ours) or perennials with flat blades and spikelike racemes of burs, the burs readily deciduous.

TYPE SPECIES: *Cenchrus echinatus* L.

KEY TO THE SPECIES

1. Burs not densely crowded in the racemes; lobes of the involucre not interlocking; first glume present.....1. *C. echinatus*.
 1. Burs densely crowded; lobes of the involucre interlocking; first glume wanting....
.....2. *C. Brownii*.
1. *Cenchrus echinatus* L., Sp. Pl. 1050. 1753; Chase, Contr. U. S. Nat. Herb. 22: 58–62. fig. 12. 1920. Type probably from Jamaica.

Annual; culms somewhat compressed, glabrous, or scabrous below the inflorescence, ascending from a geniculate or decumbent base and usually branching and rooting from the base and lower nodes, 25–60 (sometimes to 100) cm. long; sheaths usually overlapping, glabrous or more or less pubescent, especially on the margins toward the summit, loose, somewhat

keeled; ligule ciliate, about 1 mm. long; blades flat, 6–20 cm. long, 3–8 mm. wide, scabrous or sparsely pilose on the upper surface; racemes often rather long-exserted in age, 3–10 cm. long, less dense than those of *C. Brownii*, the axis scabrous; burs truncate at base, the body 4–7 mm. high, as broad or broader, pubescent, the outer slender bristles usually less numerous than in *C. Brownii*, the inner bristles stout, usually broadened at the base and equaling the lobes of the body or shorter; lobes of the body commonly 10, often pilose, erect or bent inward, sometimes one or two of the lobes inflexed; spikelets 3–6, lanceolate, acuminate, about equaling the lobes or shorter, 4.5–6 mm. long; first glume narrow, 1-nerved; second glume two-thirds to three-fourths as long as the subequal sterile and fertile lemmas.

BRITISH NEW GUINEA: Gulf Division: Kanosia, Carr 11180 (NY) (open savannah land). NORTHEAST NEW GUINEA: Morobe District: 4 miles south of Langemak Bay (near Finschhafen), Sawyer 82 (A, US).

Tropics of both hemispheres.

2. *Cenchrus Brownii* Roem. and Schult., Syst. Veg. 2: 258. 1817; Chase, Jour. Arnold Arb. 20: 313. 1939. Based on *Cenchrus inflexus* R. Br.

Cenchrus inflexus R. Br., Prod. Fl. Nov. Holl. 1: 195. 1810 (non Poir. 1804). Type from Australia.

Cenchrus viridis Spreng., Syst. Veg. 1: 301. 1825; Chase, Contr. U. S. Nat. Herb. 22: 57. fig. 11. 1920. Type from Guadeloupe.

Annual; culms glabrous or scabrous below the inflorescence only, often rather robust, 30–100 cm. tall, erect or ascending from a more or less geniculate base, sparingly branching from the base or lower nodes; sheaths glabrous, rather loose, keeled, overlapping or sometimes shorter than the internodes; ligule a row of hairs scarcely 1 mm. long; blades flat, 10–30 cm. long, 6–15 mm. wide, the upper surface and margins scabrous; racemes short-exserted, 5–12 cm. long, dense; burs depressed-globose, the body about 4 mm. high and as broad or broader, puberulent, tawny, the outer bristles very slender, numerous, crowded toward the base, the inner stouter, about equal to or longer than the body and the spikelet, retrorsely scabrous; lobes of the body 6–8, interlocking at maturity; spikelets about 3 per bur, lanceolate, acuminate, 4–5 mm. long; first glume wanting, otherwise spikelets similar to those of *C. echinatus*.

BRITISH NEW GUINEA: MacGregor 5 (US); Western Division: Daru Island, Brass 6395 (A, US) (plantation weed, not plentiful).

Indo-China and the East Indies to the Philippines, New Guinea, and Australia. Also in tropical America.

Closely related to *Cenchrus echinatus*, but differing in its more erect habit, usually broader blades, usually smaller burs with fewer spikelets and interlocking lobes, and in the absence of a first glume. Many collections reported from this region as *C. echinatus* are probably *C. Brownii*, which is much more common. *Cenchrus echinatus* is a native of the New World and has probably been introduced into New Guinea.

19. *Isachne* R. Br.

Isachne R. Br., Prodr. Fl. Nov. Holl. 1: 196. 1810.

Spikelets subglobose or ovoid, 2-flowered; glumes membranous, subequal, as long as the florets or slightly shorter (rarely exceeding the florets),

tardily deciduous, leaving the naked florets attached to the clavate pedicels; florets similar, indurate and both perfecting fruits, or the lower staminate only, usually larger than the upper and of a thinner texture, the two florets remaining attached by the minute rachilla joint and falling together. Annuals or perennials with flat blades and open or contracted panicles.

TYPE SPECIES: *Isachne australis* R. Br. = *I. globosa* (Thunb.) Kuntze.

KEY TO THE SPECIES

1. Lower floret staminate, not indurate, usually more flattened and larger than the upper.
 2. Upper floret distinctly pubescent; panicle branches with glandular bands.
 3. Spikelets 1.2–1.5 mm. long; lower floret grooved on the back. 10. *I. miliacea*.
 3. Spikelets 2–3 mm. long; lower floret rounded on the back. 11. *I. globosa*.
 2. Both florets glabrous or essentially so; panicle branches without glandular bands. 9. *I. Brassii*.
1. Lower floret mostly perfect, sometimes slightly larger than the upper, but both florets of a similar texture.
 4. Glumes 2.5–3.5 mm. long, appressed-hispid, considerably exceeding the florets. 4. *I. Schmidtii*.
 4. Glumes not more than 2 mm. long, about equaling or slightly exceeding the florets.
 5. Plants low, creeping, the upright branches not more than 15 cm. tall; blades 1.5 cm. long or less; panicles contracted, less than 2 cm. long.
 6. Spikelets 1–1.5 mm. long; plants 2–6 cm. tall. 5. *I. Myosotis*.
 6. Spikelets 1.8–2 mm. long; plants 10–15 cm. tall. 6. *I. pauciflora*.
 5. Plants not as above; panicle 2–30 cm. long, more or less open.
 7. Sheaths less than 1 cm. long, mostly tuberculate-hispid, the internodes 3–8 times as long; ligule wanting. 3. *I. confusa*.
 7. Sheaths much longer in proportion to the internodes; ligule a ring of hairs.
 8. Culms rigid, erect, ascending, or sometimes sprawling.
 9. Culms 65–150 cm. tall; panicle branches ascending or spreading; rachilla terete.
 10. Panicle axis, branches, and pedicels smooth or nearly so; panicle 15–25 cm. long. 1. *I. albens*.
 10. Panicle axis, branches and pedicels distinctly scabrous; panicle mostly 8–15 cm. long. 2. *I. arfakensis*.
 9. Culms 30–45 cm. tall; panicle branches stiffly erect; rachilla flattened. 7. *I. oblecta*.
 8. Culms weak, decumbent at base and rooting from the lower nodes.
 11. Florets glossy, the rachilla flattened. 9. *I. Brassii*.
 11. Florets papillose-roughened or pubescent, the rachilla terete. 8. *I. villosa*.

1. *Isachne albens* Trin., Sp. Gram. Ic. 1: pl. 85. 1827; Chase, Jour. Arnold Arb. 24: 87. 1943. Type from India.

Panicum albens (Trin.) Steud., Syn. Pl. Glum. 1: 96. 1854.

Isachne stricta Elmer, Leaflets Philip. Bot. 2: 463. 1908; Chase, Jour. Arnold Arb. 24: 88. 1943. Type from the Philippines.

Isachne elatiuscula Ohwi, Bot. Mag. (Tokyo) 56: 5. 1942. Type from New Guinea.

Culms rather slender, erect or sprawling, 60–150 cm. tall; sheaths rather loose, the lower shorter than the internodes; the upper often overlapping, more or less ciliate on the margins especially above, the hairs continuous with the ligule, this represented only by a row of hairs about

2 mm. long; blades rather firm, 8–18 cm. long, 5–15 mm. wide, glabrous to scabrous to appressed stiff-pubescent, the margins usually strongly scabrous, often revolute when dry; panicle pyramidal, 15–25 cm. long, the axis and branches smooth or nearly so, the branches ascending or spreading when mature, rather rigid and densely flowered to loosely flowered and more or less lax; spikelets 1.3–1.8 mm. long, subglobose; glumes equal, 7-nerved, equaling the spikelet or slightly shorter, glabrous or more or less hispid toward the tips; florets alike, orbicular to elliptic, obtuse, glabrous or puberulent, the short rachilla terete.

NORTHEAST NEW GUINEA: Morobe District: Yunzaing, alt. about 1300 m., *Clemens* 4105 (A, US) (seepage over rock slope); Ogeramngang, alt. 1600–1700 m., *Clemens* 4592 (A), 5409, 6958a (A, US); Samanzing, alt. about 2000 m., *Clemens* 9239 (US) (margin of mountain rivulet), *Clemens* 10379 (US) (hamlet watercourse, on the bank with *Glyceria*). NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, alt. 2200 m., *Brass* 11559 (A, US) (common in open secondary forest; scrambling or in suberect clumps 1–1.5 meters high); Angi, Arfak Mountains, alt. 1900 m., *Kanehira & Hatusima* 14019 (type coll. of *I. elatiuscula*, A) (in the forest by Lake Gita).

Indo-Malayan region to New Guinea.

Isachne elatiuscula Ohwi is described as differing from *I. albens* in its firmer and denser panicle. Examination of an isotype (A) shows that the panicle is more dense and the panicle branches more densely flowered than typical *I. albens*. This character does not seem to be reliable, however, when it is seen that there are numerous intergrades between specimens with open panicles and loosely flowered branches and those of the type represented by *I. elatiuscula*.

Clemens 6958a was cited as *Isachne scabrosa* Hook. f. by Chase (18, p. 87).

2. *Isachne arfakensis* Ohwi, Bot. Mag. (Tokyo) 56: 4. 1942. Type from New Guinea.

Culms ascending or sprawling, freely branching, 65–110 cm. tall, scabrous below the inflorescence, otherwise glabrous and smooth; sheaths mostly shorter than the internodes, ciliate on the margins, the hairs continuous with the 2 mm. long ciliate ligule, the sheaths otherwise glabrous or slightly pubescent toward the summit; blades flat, rather firm, 5–15 cm. long, 6–12 mm. wide, scabrous above, more or less appressed-pubescent below, the margins scabrous; panicle 8–20 cm. long, oblong-ovate, the axis and stiffly ascending branches scabrous; spikelets subglobose, 1.5–1.8 mm. long; glumes 7-nerved, equaling the spikelet or the first slightly shorter, obtuse, glabrous or minutely scaberulous, the tips sometimes hispid; florets subequal, glabrous or minutely puberulent, especially on the margins, separated by a very short terete rachilla.

BRITISH NEW GUINEA: Central Division: Mt. Tafa, alt. 2400 m., *Brass* 4871 (GH, US) (plentiful on open banks of a small stream flowing over landslide debris). NORTHEAST NEW GUINEA: Morobe District: Samanzing, alt. 1800 m., *Clemens* 9209 (US) (landslide near little waterfall). NETHERLANDS NEW GUINEA: Angi, Arfak Mountains, alt. 1900 m., *Kanehira & Hatusima* 13588 (TYPE FRAGMENT, A) (in open marsh by Lake Gita).

Known only from New Guinea.

In the original description, Ohwi describes this species as having blades

5–8 cm. long, 6–7 mm. wide, and a panicle about 8 cm. long. The Brass specimen (at US) is a good match for the type except that the blades are up to 9 mm. wide and the panicles are 10–14 cm. long. A duplicate of this same Brass collection (at GH) has blades more than 15 cm. long and 12 mm. wide. The panicle is 20 cm. long. In all other respects these specimens agree well with each other and with Ohwi's original description and a fragment of the type (at A). *Brass* 4817 [4871] was reported as *Isachne pangerangensis* Zoll. and Mor. by Hitchcock (35, p. 123) and as *I. scabrosa* Hook. f. by Chase (18, p. 87).

3. *Isachne confusa* Ohwi, Tokyo Sci. Mus. Bull. 18: 14. 1947. Type from Sumatra. *Isachne firmula* sensu Hitchc., Brittonia 2: 123. 1936.

Isachne Rhignon (Steud.) Ohwi, Bot. Mag. (Tokyo) 55: 541. 1941, excl. syn.

Culms erect or spreading, 15–60 (commonly about 30) cm. tall, simple below, branching from the upper nodes, the internodes elongate; sheaths much shorter than the internodes, about 0.5 cm. long, glabrous to tuberculate-hispid; ligule wanting; blades lanceolate, firm, prominently nerved, usually scabrous above, the margin often pectinate, 10–20 mm. long, 4–8 mm. wide; panicle 2–4 cm. long, 1.5–3 cm. wide, the branches stiffly divergent, some of them with glandular bands; pedicels rather stout, clavate, these and the panicle branches glabrous; spikelets about 1.3 mm. long, the obtuse hispid glumes barely equaling the florets; florets alike, both perfect, pale to tawny, granular-roughened, about 1 mm. long.

BRITISH NEW GUINEA: Western Division: Wuroi, Oriomo River, *Brass* 5854 (GH, US) (small area of tea tree marsh on savannah); Lake Daviumbu, Middle Fly River, *Brass* 7832 (A, US) (scattered through coarser grass on wet plain).

India, China, Philippines, Netherlands Indies to New Guinea.

4. *Isachne Schmidtii* Hack., Bot. Tidsskrift 24: 97. 1901. Type from Siam. *Isachne semitalis* Ridl., Fl. Malay Peninsula 5: 237. 1925. Type from Malay Peninsula.

Annual; culms creeping, the ascending flowering branches 5–20 cm. tall; sheaths overlapping or slightly shorter than the internodes, glabrous except for the ciliate margins, the hairs on the upper part stiff and continuous with the ciliate ligule, this about 1 mm. long; blades lanceolate to ovate-lanceolate, 1.5–5 cm. long, 5–9 mm. wide, glabrous to more or less scabrous-hispid especially below, the margins prominently scabrous; panicle contracted to rather open, 1–4 cm. long, the scabrous, angled branches stiffly ascending; spikelets 2.5–3.5 mm. long on clavate pedicels; glumes rigid-hispid, ovate, exceeding the florets, subequal, the lower slightly longer; florets similar, oval or elliptic, obtuse, one-fourth to one-third (rarely half) shorter than the glumes, glabrous or the lemmas slightly hispid on the inrolled margins.

SOLOMON ISLANDS: Ysabel: Tiratona, *Brass* 3405 (GH) (shady pathways in mountain forests).

Siam, Malay Peninsula, Philippines to New Guinea.

Hackel described the species as only about 6 cm. tall and with the glumes twice as long as the florets. A specimen in the National Herbarium (obtained from the Hackel Herbarium in Vienna by Agnes Chase and labeled *Isachne Schmidtii* in Hackel's handwriting) is a tiny plant only about 4.5 cm. tall and with a small panicle of only 4 spikelets. Except

for its size, the plant agrees in all respects with the cited specimen and with others like it from the Malay Peninsula and the Philippines. The species seems well characterized by its rather large spikelets with pointed hispid glumes noticeably longer than the florets.

5. *Isachne Myosotis* Nees, Jour. Bot. Kew Misc. 2: 98. 1850; White, Proc. Roy. Soc. Queensl. 34: 16. 1923. Type from the Philippines.

Panicum Myosotis (Nees) Steud., Syn. Pl. Glum. 1: 96. 1854.

Isachne grisea K. Schum. in K. Schum. and Lauterb., Nachtr. Fl. Deutsch.Schutzgeb. Südsee 57. 1905; Ohwi, Bot. Mag. (Tokyo) 56: 4. 1942. Type from Northeast New Guinea.

Isachne micrantha Merr., Philip. Jour. Sci. Bot. 5: 168. 1910; Chase, Jour. Arnold Arb. 24: 87. 1943. Type from the Philippines.

Low annual; culms freely branching, more or less tufted or creeping and forming mats, the flowering branches 2–6 cm. tall; sheaths overlapping, sparsely to densely pilose, the hairs sometimes tuberculate-based; ligule a row of hairs about 1 mm. long continuous with the ciliate margins of the sheaths; blades ovate to ovate-lanceolate, 5–15 cm. long, 2–4 mm. wide, densely pubescent to papillose-pilose, the hairs rarely somewhat appressed; panicle exserted, few-flowered, 7–16 mm. long, the branches usually strict, glabrous; spikelets 1–1.5 mm. long, subglobose when mature, the glumes similar, about equaling the spikelet, obtuse, subglabrous to rather densely hispid (usually with a few stiff hairs at least toward the tips); florets similar in appearance, about 1 mm. long or slightly more, more or less densely puberulent.

BRITISH NEW GUINEA: Central Division: Murray Pass, Wharton Range, alt. 2840 m., *Brass* 4642 (GH, US) (appearing early on burnt grasslands); Rouna, Carr 12412 (NY) (seepage point above south bank of Laloki River); Nauro-Elobi Divide, Carr 12971 (US). NORTHEAST NEW GUINEA: Morobe District: Sattelberg, alt. about 90 m., *Clemens* 312 (A, US); Sarawaket, alt. about 250 m., *Clemens* 6097 (A); Wantoat, alt. about 100 m., *Clemens* 40885 (US). NETHERLANDS NEW GUINEA: Lake Habbema, alt. 3225 m., *Brass* 9556 (A, US) (locally plentiful on open boggy ground); 9 km. northeast of Lake Habbema, alt. 2800 m., *Brass* 10704 (A) (plentiful on native clearing in forest); Bele River, 18 km. northeast of Lake Habbema, alt. 2200 m., *Brass* 11583 (A, US) (abundant in native gardens); 4 km. southwest of Bernhard Camp, Idenburg River, alt. 850 m., *Brass* 13201 (A, US) (matted on flood washed rocks on river bank); Nassau Region, Explorat Biv., alt. about 1200 m., *Docters van Leeuwen* 10787 (GH).

Philippines and New Guinea.

The type specimen of *Isachne Myosotis* (fragment at US) has spikelets 1.2–1.5 mm. long, with glumes prominently hispid. The type of *I. micrantha* (US) has spikelets 1–1.3 (rarely 1.5) mm. long, glumes subglabrous or with only a few hairs near the apex, and the lemmas perhaps slightly more hairy than is usual for *I. Myosotis*. In other respects they are very similar, having the same characteristic habit and foliage. No type material of *I. grisea* was available for comparison, but from the description and study of material from near the type locality, it seems evident that it is merely a synonym of *I. Myosotis*.

Carr 12971 is a somewhat taller plant than usual, but the culms are very slender and the blades thin. It is probably a shade form and a note on the label states "path in forest."

Brass 4642 was cited as *Isachne pauciflora* by Hitchcock (35, p. 123).

6. *Isachne pauciflora* Hack., (Philip.) Bur. Govt. Lab. Bull. 35: 80. 1906.

Type from the Philippines.

Aquatic or semi-aquatic; culms weak, rooting below, the flowering branches 10–15 cm. long, glabrous; sheaths rather loose, about half as long as the internodes, more or less densely papillose-hirsute, especially below, the margins ciliate and continuous with the ligule, this about 1 mm. long; blades ovate-lanceolate, acute, 1–1.5 cm. long, about 4 mm. wide, subglabrous or more or less papillose-pilose, the hairs sometimes appressed, the margins scabrous; panicle few-flowered, strict, contracted, about 1.5 cm. long, the rachis and stiff branches glabrous; spikelets 1.8–2 mm. long; glumes equaling the spikelet, obtuse or appearing apiculate by the inrolling of the margins in drying, more or less densely hispid especially toward the tips; florets equal or nearly so, broadly oval, obtuse, densely puberulent, 1.5–1.8 mm. long.

BRITISH NEW GUINEA: Base of Rouna Falls, Carr 12362 (NY, US) (on rocks exposed to continual sprays).

Philippines and New Guinea.

Similar to *Isachne Myosotis* and perhaps not distinct from that species. The only noticeable differences are the elongated culms with sheaths about half as long as the internodes, and the slightly larger spikelets. The cited specimen compares favorably with a type duplicate (at US).

7. *Isachne obtecta* sp. nov. PLATE IV.

Perennis 30–45 cm. alta; culmis caespitosis, glabris, suberectis vel adscendentibus, circiter 1 mm. diametro; nodis glabris, eis infra medium culmi saepe ramiferis; vaginis glabris quam internodiis brevioribus, marginibus ciliatis; ligula ad lineam ciliatam 2–3 mm. longa reducta; laminis lanceolato-linearibus, 2–6 cm. longis, 3–6 mm. latis, acutis, subcordatis, praecipue subtus plus minusve villosis, supra saepe pilis paucis adspersis, marginibus scabris; panicula longe exserta, 5–8 cm. longa, contracta, ramis rigidis, erectis, floribus confertis; rhachi ramisque teretibus, glabris vel sub lente minute scaberulis; pedicellis clavatis; spiculis glabris, 1.5 mm. longis; glumis aequalibus, ellipticis vel plus minusve obovatis, nervis obscuris, circiter 7, marginibus scariosis, paene flosculas obtegentibus; flosculis aequalibus et fructiferis, ellipticis, nitidis, rhachilla complanata junctis, floscula infima interdum paulum dorso-complanata.

BRITISH NEW GUINEA: Western Division: Palmer River, 2 miles below junction with Black River, alt. 100 m., Brass 7242 (A, TYPE, US) July, 1936 (common in native gardens).

In some respects this species suggests *Isachne Brassii*, but it is readily distinguished by the more upright firmer culms, somewhat villous blades, the much contracted panicle, and the slightly smaller spikelets with glumes almost completely covering the florets. The florets, moreover, are of almost exactly the same size and the tip of the upper is borne slightly above the lower. In *I. Brassii* the tips of the florets are borne at the same height and the upper floret is smaller and more convex on the back. The new species may also be compared with *I. villosa*, but that species has papillose-roughened or pubescent florets which are joined by a terete rachilla.

The specific epithet refers to the fact that the florets are almost completely covered by the glumes.

8. *Isachne villosa* (Hitchc.) comb. nov.

Isachne Brassii Hitchc. var. *villosa* Hitchc., Brittonia 2: 123. 1936; Chase, Jour. Arnold Arb. 24: 87. 1943. Type from British New Guinea.

Culms glabrous, branching at base, decumbent and rooting at the lower nodes, the ascending flowering branches 10–40 cm. tall; nodes bearded; sheaths more or less papillose-pilose, often densely so, sometimes only on the upper part, ciliate on the margins, the hairs continuous with the fringe of stiff hairs forming the ligule, this 1–2 mm. long; blades lanceolate, 1.5–10 cm. long, 3–7 mm. wide, more or less villous, usually densely so below; panicle open, 3–12 cm. long, the branches ascending, rather loosely flowered; spikelets 1.2–1.8 mm. long, upright on the pedicels; glumes about equaling the spikelet, elliptic to narrowly obovate, glabrous; florets similar, equal or the upper slightly smaller, separated by a short terete rachilla, both florets of the same texture, papillose-roughened and more or less puberulent, the hairs often rather long and curled; upper floret sometimes slightly more hairy than the lower.

BRITISH NEW GUINEA: Central Division: Mt. Tafa, alt. 2100 m., *Brass* 4132 (TYPE COLL., GH, US) (small roadside grass); Borizi, alt. about 1400 m., *Carr* 14271 (NY); without precise locality, *MacGregor* 50 (US). NORTHEAST NEW GUINEA: Morobe District: Boana, alt. 700–1300 m., *Clemens* 41714 (US); Kaile, alt. about 1600 m., *Clemens* 4860 (A); Sarawaket, alt. about 1800 m., *Clemens* 4956, 5856, 5924 (A). NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, alt. 1500 m., *Brass* 12370 (A, US) (rain-forest; on sand in the bed of a small stream); 18 km. southwest of Bernhard Camp, Idenburg River, alt. 2150 m., *Brass* 12475 (A, US) (one small clump on an open rock slide).

Philippines, New Guinea.

Related to *Isachne Brassii* Hitchc., but differing in having a terete rather than flattened and obdeltoid rachilla; the florets papillose-roughened and more or less short-pubescent, the sheaths papillose-pilose, and the blades tomentose, at least on the lower surface. This species may also be compared with *I. Beneckii* Hack., but that species has subglobose spikelets with glumes broadly oval and more or less hispid, at least toward the tips.

9. *Isachne Brassii* Hitchc., Proc. Linn. Soc. N. S. Wales 54: 146. 1929, Brittonia 2: 123. 1936; Ohwi, Bot. Mag. (Tokyo) 56: 5. 1942. Type from British New Guinea.

Culms glabrous, branching at base, decumbent and rooting at the lower nodes, the ascending flowering branches 8–50 cm. tall; sheaths glabrous or minutely pubescent, the margins ciliate, the hairs continuous with the fringe of stiff hairs which forms the ligule, this 1–2 mm. long; blades narrowly oblong-lanceolate, 1.5–7 cm. long, 3–8 mm. wide, scabrous on both surfaces and sometimes with a few scattered stiff hairs; panicle elliptic, 3–10 cm. long, open, the branches ascending, the spikelets short-pedicel along the main branches; spikelets 1.5–1.7 mm. long, borne obliquely on the pedicels; glumes about equaling the spikelet, narrowly obovate, more or less hispid especially toward the tips; florets essentially glabrous and more or less glossy, equal in height but the lower larger, often grooved on the back and of a slightly thinner texture, the upper more convex on the back and separated from the lower by a flattened rachilla which is broader at the apex. When seen before the glumes have fallen

the two florets appear similar, as the slight difference in texture is not striking.

BRITISH NEW GUINEA: Gulf Division: Ihu, Vailala River, *Brass* 1018 (TYPE COLL., GH, US) (small swamp grass); Western Division: Palmer River, 2 miles below junction with Black River, alt. 100 m., *Brass* 7364 (A, US) (matted on sand drifts in river). NORTHEAST NEW GUINEA: Morobe District: *Ledermann* 10444 (US); Boana, alt. about 900 m., *Clemens* (sine coll. no.), October 20, 1940 (US). NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, alt. 50 m., *Brass* 14055 (A, US) (massed on logs floating in backwater lagoons); Waren, 60 miles south of Manokwari, alt. 3 m., *Kanehira and Hatusima* 14221 (A) (on edge of rain-forest).

Endemic.

10. *Isachne miliacea* Roth ex Roem. and Schult., Syst. Veg. 2: 476. 1817; Ridley, Trans. Linn. Soc. II. Bot. 9: 247. 1916; Blatter and McCann, Imp. Council Agric. Res. Sci. Monogr. 5: *pl.* 123. 1935. Type from eastern India.

Culms weak, decumbent and creeping, the ascending flowering branches 6–20 (rarely to 30) cm. tall; nodes usually bearded; sheaths shorter than the internodes, glabrous except for the ciliate margin, the cilia continuous with the stiff hairs forming the ligule; blades narrowly oblong, 1–3 cm. long, 3–6 mm. wide, acute, subcordate at base, hispidulous or glabrous, the margins scaberulous; panicle open, 2–5 cm. long, included at base, the branches glandular, ascending, up to 1.5 cm. long; spikelets 1.2–1.5 mm. long; glumes subequal, smooth or scaberulous toward the summit; lower floret staminate, equaling or slightly longer than the glumes, the lemma commonly grooved down the center at maturity; upper floret perfect, ovoid, puberulent, separated from the lower floret by a flattened rachilla.

Indo-Malayan region to New Guinea.

No New Guinea specimens of this species were seen. The description was drawn up from Philippine material. It is included here since it has been reported from Netherlands New Guinea, and its occurrence in New Guinea seems probable.

11. *Isachne globosa* (Thunb.) Kuntze, Rev. Gen. Pl. 2: 778. 1891; Chase, Jour. Arnold Arb. 20: 312. 1939.

Milium globosum Thunb., Fl. Jap. 49. 1784. Type from Japan.

Isachne australis R. Br., Prodr. Fl. Nov. Holl. 1: 196. 1810; F. Muell., Pap. Pl. 2: 19. 1885; Blatter and McCann, Imp. Council Agric. Res. Sci. Monogr. 5: *pl.* 122. 1935. Type from Australia.

Isachne rhabdina (Steud.) Ohwi, Tokyo Sci. Mus. Bull. 18: 1. 1947.

Perennial; culms slender, spreading, often decumbent below and branching, rarely suberect from a tufted base, the flowering branches 15–70 cm. tall; sheaths mostly shorter than the internodes, smooth, ciliate on the margins, the hairs on the upper part longer and continuous with the ciliate ligule, this 2–3 mm. long; blades linear-lanceolate, 2–8 (rarely up to 13) cm. long, 3–8 mm. wide, rather firm in texture, scaberulous; panicle 2–10 cm. long, 2–6 mm. wide, the smooth or scabrous branches ascending and with more or less distinct glandular bands; spikelets 2–2.5 (rarely 3) mm. long; glumes equaling the spikelet or slightly shorter, glabrous or hispidulous toward the obtuse apex; lower floret staminate, slightly larger and of a thinner texture than the glabrous or pubescent perfect floret.

BRITISH NEW GUINEA: Central Division: Vanapa Valley, Urunu, alt. 1900 m., *Brass* 4807 (GH, US) (very plentiful in grassland swamps); Western Division: Lake Daviumbu, Middle Fly River, *Brass* 7602 (A, US) (plentiful on shores of lake). NETHERLANDS NEW GUINEA: 9 km. northeast of Lake Habbema, alt. 2800 m., *Brass* 10743 (A, US) (abundant on a native clearing in the forest); Bele River, 18 km. northeast of Lake Habbema, alt. 2200 m., *Brass* 11542 (A, US) (plentiful on sandy beaches of river and on old garden lands); Balim River, alt. 1600 m., *Brass* 11823 (A, US) (plentiful on deforested slopes).

Japan to India, Malaysia, New Guinea and Australia.

Brass 7602 is a more robust plant than the others cited, the spikelets are slightly larger and with glumes shorter than the spikelets. Comparison with specimens from other parts of the range, however, show that these differences fall well within the range of variation of the species.

Brass 4807 was cited as *Isachne pangerangensis* Zoll. and Mor. by Hitchcock (35, p. 123).

20. *Spinifex* L.

Spinifex L., Mant. 2: 163, 300. 1771.

Spikelets lanceolate, unisexual, the pistillate solitary at the base of a long stiff or somewhat flexuous rachis, these stellately arranged in dense spatheate umbels, the heads breaking off at maturity and carried about by the wind or floating on the sea; staminate spikelets borne on rigid spikes, these in spatheate umbels like the pistillate; glumes membranous, the first about half the length of the staminate spikelet, in the pistillate equal to the spikelet; fertile lemma chartaceous-indurate, acuminate, the margins not inrolled. Coarse dioecious perennials with rigid involute or subulate blades and stiff stellate inflorescences.

TYPE SPECIES: *Spinifex squarrosus* L. = *S. littoreus* (Burm. f.) Merr. (*Stipa littorea* Burm. f.).

1. *Spinifex littoreus* (Burm. f.) Merr., Philip. Jour. Sci. Bot. 7: 229. 1912.

Stipa littorea Burm. f., Fl. Ind. 29. 1768. Type from India.

Stipa spinifex L., Mant. 1: 34. 1767. Type from India.

Spinifex squarrosus L., Mant. 2: 300. 1771. Type from India.

Perennial; culms hard, 30–100 cm. or more tall, the internodes more or less pruinose; sheaths broad, overlapping, glabrous or the margins ciliate; ligule a dense ring of hairs 2–4 mm. long; blades 5–20 cm. long, involute-subulate, usually curved, glabrous or the margins scabrous, the tips sharp-pointed; staminate spikelets 2-flowered, 10–12 mm. long, usually several on each spike, the rachis 4–9 cm. long and terminating in a stiff point beyond the spikelets; glumes unequal, the first 5–6 mm. long, the second slightly shorter than the spikelet; florets subequal, the lower membranous, the palea with prominently winged ciliate keels, the upper slightly indurated, the palea not keeled; pistillate spikelets 10–12 mm. long, borne at the base of the scabrous rachis, this 8–15 cm. or more long; first glume equal to or exceeding the spikelet; second glume and sterile lemma equal, the latter empty; fertile lemma a little shorter than the sterile lemma and enclosed within it.

Sandy coasts from India to South China and Malaysia.

- 1a. *Spinifex littoreus* (Burm. f.) Merr. var. *longifolius* (R. Br.) Backer, Handb. Fl. Java 2: 188. 1928.

Spinifex longifolius R. Br., Prodr. Fl. Nov. Holl. 1: 198. 1810; Pilger, Nat. Pflanzenfam. ed. 2. 14e: 94. fig. 58. 1940. Type from Australia.

Differs from the species in having longer often broader and weaker blades (20–50 cm. long), the apex not rigidly pointed, and the rachis of the pistillate inflorescence more slender.

BRITISH NEW GUINEA: Central Division: Hisiu, Carr 11445 (US, NY). Australia, New Guinea, and Java.

21. *Thuarea* Pers.

Thuarea Pers., Syn. Pl. 1: 110. 1805.

Ornithocephalochloa Kurz, Jour. Bot. 18: 332. 1875.

Spikelets of two kinds borne in a terminal one-sided raceme included within a sort of spathe at anthesis, the lower 1 or 2 spikelets perfect or pistillate, the upper 3–6 staminate; rachis broad at the base and more or less enclosing the lowest spikelet, narrowed above; upper spikelets with two similar staminate florets, or the lower floret empty; lower 1 or 2 spikelets with one staminate or empty floret and one perfect or pistillate floret. Slender creeping beach grasses. As the fruit matures, the staminate spikelets on the upper part of the rachis fall off and the rachis begins to bend forward and finally encloses the ripened fruit within the perfect spikelet. As this is occurring, the upright branch bends by unequal growth at two or three nodes and the fruit is buried in the sand. The fructification thus formed is more or less waterproof and the seed inside is protected and may float for a considerable time in salt water without injury.¹⁷

TYPE SPECIES: *Thuarea sarmentosa* Pers. = *T. involuta* (G. Forst.) R. Br. (*Ischaemum involutum* G. Forst.).

1. *Thuarea involuta* (G. Forst.) R. Br.¹⁸ ex Roem. and Schult., Syst. Veg. 2: 808. 1817; Hack., Denkschr. Akad. Wiss. Math.-Naturw. (Wien) 89: 495. 1913.

Ischaemum involutum G. Forst., Fl. Ins. Austr. Prodr. 73. 1786. Habitat in the Society Islands and here and there in the tropics.

Thuarea sarmentosa Pers., Syn. Pl. 1: 110. 1805; Kunth, Rev. Gram. 2: 247. pl. 35. 1830; K. Schum. and Lauterb., Fl. Deutsch. Schutzgeb. Südsee 182. 1901. Type from Madagascar.

Ornithocephalochloa arenicola Kurz, Jour. Bot. 18: 332. pl. 171, fig. 1–18. 1875. Type from Nicobar Islands.

Culms creeping, forming mats, the upright flowering branches 5–20 cm. tall; sheaths and blades glabrous to more or less velvety-pubescent; sheaths overlapping, ciliate on the margins; ligule a row of hairs 0.5–1 mm. long; blades lanceolate, 2–5 cm. long, 3–6 mm. wide; inflorescence a terminal raceme, the spikelets borne in one series on the puberulent rachis; spikelets puberulent, the staminate about 4 mm. long; first glume small, hyaline; second glume about as long as the spikelet; florets similar, the upper lemma slightly firmer, both containing a staminate flower, or the lower empty; perfect spikelets slightly larger, the glumes and sterile lemma similar to those of the staminate spikelets, the lemma containing a palea and sometimes a staminate flower; fertile floret perfect or pistillate, the lemma smooth and shining except for a few hairs at the apex, the margins clasping the lemma but not inrolled.

¹⁷ For a detailed discussion of this interesting phenomenon, see Nieuwenhuis-Uexküll, Margarete (Ann. Bot. Jard. Buitenzorg 18: 114–123. pl. 14, 15. 1902).

¹⁸ Robert Brown (Prodr. Fl. Nov. Holl. 1: 197. 1810) mentions *Ischaemum involutum* G. Forst. under *Thuarea*, but the combination is not made there.

BRITISH NEW GUINEA: Central Division: Hisiu, *Carr 11417* (NY) (sandy beach). SOLOMON ISLANDS: San Cristoval: Star Harbor, *Brass 3070* (GH).

Islands of the Indian Ocean to Malaysia, New Guinea, Northern Australia, and Islands of the Pacific.

22. *Melinis* Beauv.

Melinis Beauv., Ess. Agrost. 54. *pl. 11, fig. 4.* 1812.

Tristegis Nees, Hor. Phys. Berol. 47. *pl. 7.* 1820.

Spikelets small, ovate to elliptic, somewhat laterally compressed; first glume minute, nerveless; second glume equaling the sterile lemma, prominently nerved, 2-lobed at apex and bearing a short mucro from between the lobes; sterile lemma similar to the second glume, but bearing a long straight and slender awn; fertile lemma and palea weakly cartilaginous, shorter than the sterile lemma. Annuals or perennials with small spikelets borne in panicles.

TYPE SPECIES: *Melinis minutiflora* Beauv.

1. *Melinis minutiflora* Beauv., Ess. Agrost. 54, *pl. 11, fig. 4.* 1812. Type from Brazil.

Tristegis glutinosa Nees, Hor. Phys. Berol. 29, 47, 54, *pl. 7.* 1820. Type from Brazil.

Panicum Melinis Trin., Mém. Acad. St. Petersb. VI. Sci. Nat. 1: 291. 1834. Based on *Melinis minutiflora* Beauv.

Glandular perennial; culms 1 meter or more long, erect or geniculately ascending, often rooting from the lower nodes, usually much branched, glabrous or somewhat pubescent; nodes bearded; sheaths papillose-pilose; ligule a ring of whitish hairs about 1 mm. long; blades flat, pubescent, 5–15 cm. long, 5–12 mm. wide; panicle narrow, more or less contracted, densely flowered, 15–25 cm. long, the slender branches and pedicels scaberulous; spikelets 1.8–2 mm. long, the awn of the sterile lemma 10–15 mm. long.

NORTHEAST NEW GUINEA: Morobe District: Boana, alt. 700–1400 m., *Clemens 11361* (US).

EXPLANATION OF PLATES

All figures are drawn from types.

PLATE I

Brachiaria fusiformis Reeder (*Brass* 3639): a. habit, $\times \frac{1}{2}$; b & c. two views of spikelet; d. fertile floret (b-d, $\times 10$).

PLATE II

Digitaria abortiva Reeder (*Carr* 11108): a. habit, $\times \frac{1}{2}$; b. part of rachis; c & d. two views of spikelet (b-d, $\times 10$).

PLATE III

Setaria montana Reeder (*Brass* 11488): a. habit, $\times \frac{1}{2}$; b & c. two views of spikelet, $\times 10$.

PLATE IV

Isachne oblecta Reeder (*Brass* 7242): a. habit, $\times \frac{1}{2}$; b. complete spikelet; c & d. two views of spikelet with glumes removed (b-d, $\times 10$).

(*To be concluded*)



GRAMINEAE-PANICOIDEAE OF NEW GUINEA



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